AVIATION WEEK

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APR. 12, 1954

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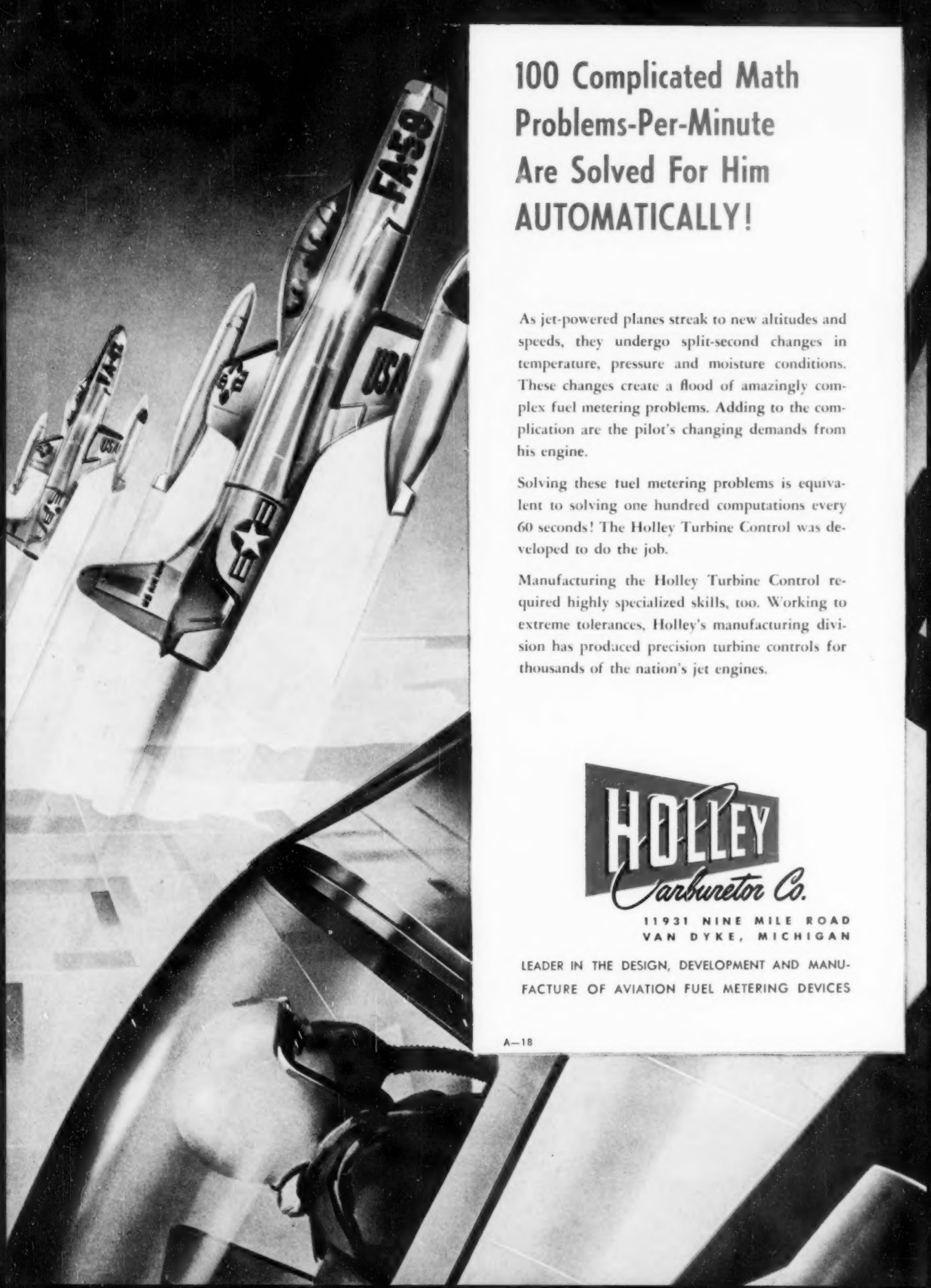

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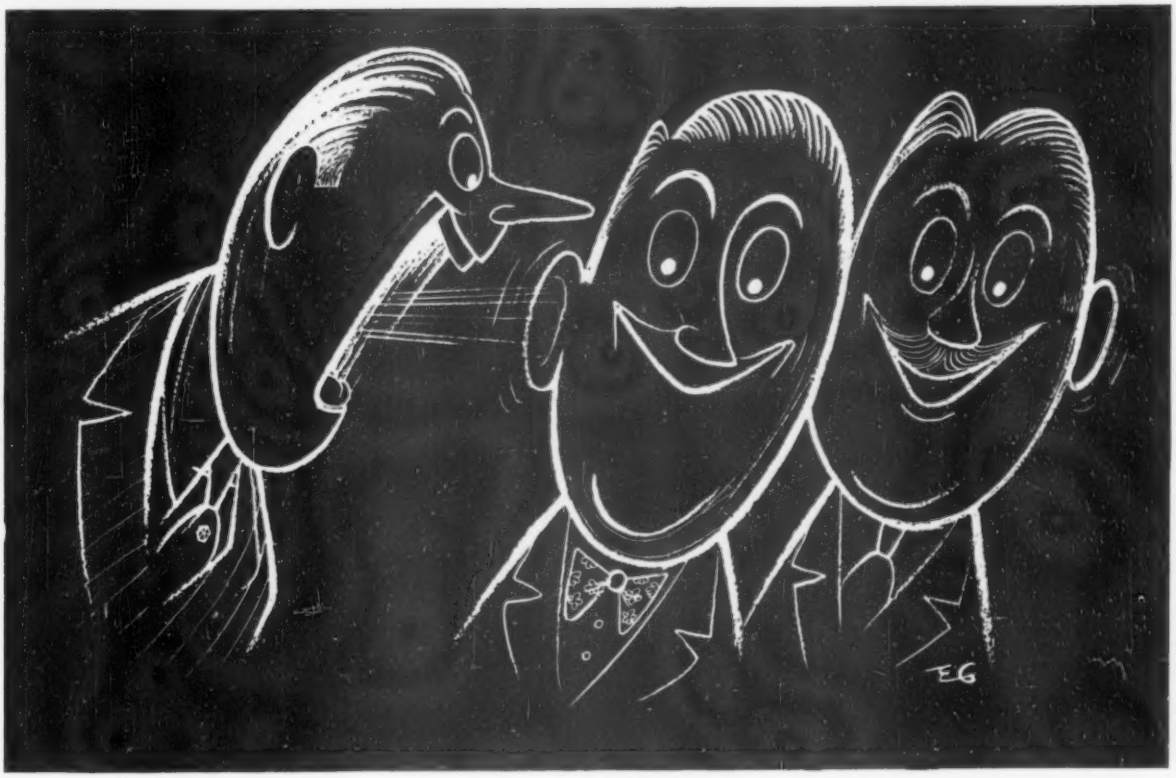

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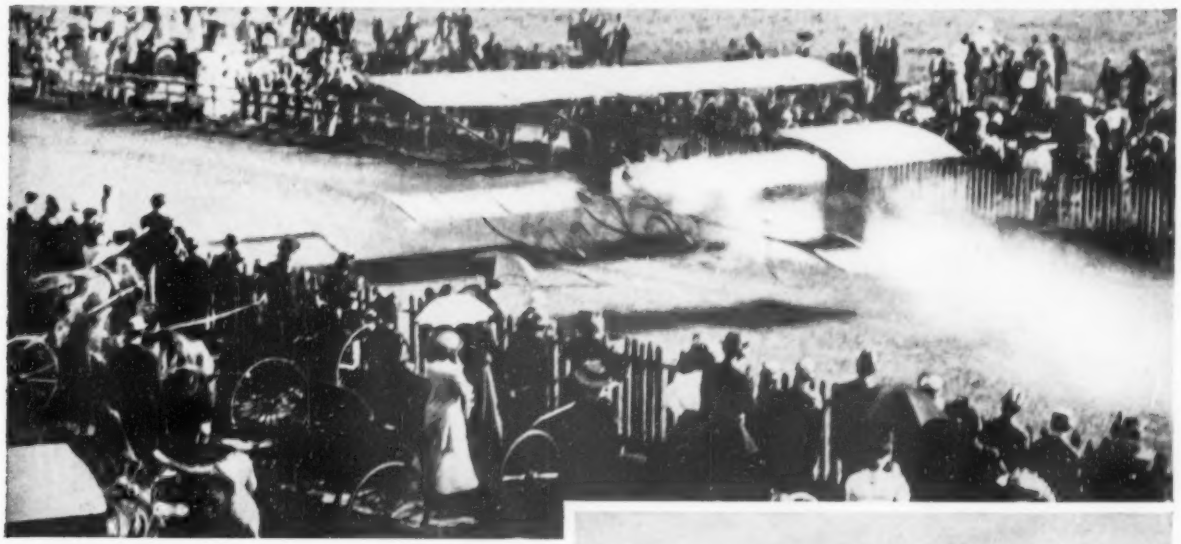
Hold the horses! Here comes the flying machine!



IN 1910 crowds gathered—and horses shied—whenever men set out to try their wings. That year Allan Lockheed exhibited a pusher-type bi-plane to a group of excited Californians, above. It flew successfully, and a few years later, Allan and his brother Malcolm Lockheed introduced an airplane of their own design (right) to the public at the 1915 Pacific International Exposition in San Francisco. It was the first successful tractor tandem seaplane, and became the first of a long line of Lockheed aircraft!

THE NEW U. S. AIR FORCE RC-121C, one of Lockheed's latest, carries America's most powerful search radar to high altitudes for line-of-sight surveillance. Thanks to the fuel-saving combination of high compression engines and high octane aviation gasoline (for which the RC-121C has tremendous capacity) these flying radar stations can stay airborne for extended periods of time. Similar radar planes are in production at Lockheed for the U. S. Navy which plans to use them as far-ranging forward eyes of the fleet.

Progress in aviation depends on progress in many other industries. In the field of aviation fuels, Phillips Petroleum Company has pioneered important improvements.

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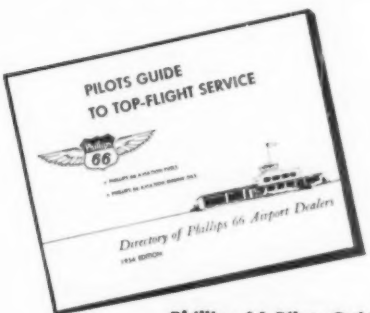

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NEWS DIGEST

Domestic

Boeing Airplane Co. reveals its commercial 707 jet transport will be named the Stratoliner. Name selected for the military version: Stratotanker.

Lockheed RT-33, four-camera photo reconnaissance version of the T-33 trainer, is in production at the aircraft builder's Burbank, Calif., plant. Operational endurance of the single-seat jet will be 20% greater than the standard T-33's 3 hr. 12 min. Deliveries are earmarked for Mutual Defense Assistance Pact countries.

Flying Tiger Line and Slick Airways have set May 1 as target date for merger of the two air cargo lines, approved by Civil Aeronautics Board last January but delayed by a pilot seniority dispute.

Low-cost GCA for small airports, first U. S. development patterned after similar British radar (AVIATION WEEK Jan. 11, p. 43), was demonstrated last week by Laboratory for Electronics, Inc., at Boston Logan Airport.

Air Transport Assn.'s new airport passenger terminal service committee has launched a program aimed at improving and standardizing passenger facilities in airports. Elected to spearhead the job as committee chairman: J. B. Franklin, vice president in charge of operations and maintenance for Capital Airlines.

Brig. Gen. Milton W. Arnold (USAF Ret.) vice president of Air Transport Assn., has filed a $1-million alienation-of-affection suit against George M. Bunker, president of Glenn L. Martin Co. Arnold says he and his wife were divorced Feb. 17, that she married Bunker four days later. Arnold also alleges alienation of affection of his seven-year-old adopted son.

Col. William H. Councill, 42, who set a speed record on a flight from Los Angeles to New York in an F-80 Jan. 26, 1946, has been missing since Apr. 5 on a flight from Farmingdale, N. Y., to Langley AFB, Va., in a T-33.

Financial

Eastern Air Lines' net income for 1953 dropped to $7,921,367 from $8,513,681 in 1952, despite record operating revenues that increased 22% to $144,468,385. EAL gives this reason for the profit dip: $12 million in taxes, compared with $9.3 million in 1952.

Eisenhower Signs AF Academy Bill

Sen. Homer Capehart, left, reaches around USAF Secretary Harold Talbott to shake President Eisenhower's hand after the Chief Executive had signed a bill establishing a separate academy for the Air Force. USAF Chief of Staff, Gen. Nathan Twining (third from left), also witnessed the historic occasion. Talbott has named a commission to select an Air Academy site, including Charles A. Lindbergh; Hearst executive Merrill Meigs; Iowa University president Virgil Hancher; retired Gen. Carl Spaatz, former USAF Chief of Staff, and Lt. Gen. Hubert Harmon, special assistant to Gen. Twining (also see storp p. 22).

Northwest Orient Airlines reports net income of $1,944,693 for last year, higher by $155,356 than 1952's $1,789,337. The total included $1,339,503 in operating income after taxes plus $604,190 in property sales. NWA directors took no action at the last board meeting on the May 1 quarterly dividend on 4.6% cumulative preferred stock, first payment due since Harold R. Harris resigned as president.

Seaboard & Western Airlines' revenues increased 13% during 1953 to an all-time high of $13,638,231, but net income declined to $351,179 from $567,980 in 1952. Company blames the income drop on "lower prices stemming from increased competition and increased costs."

Kaman Aircraft Corp., Bloomfield, Conn., reports its board of directors has voted to change the company's stock from no par to $1 per share.

International

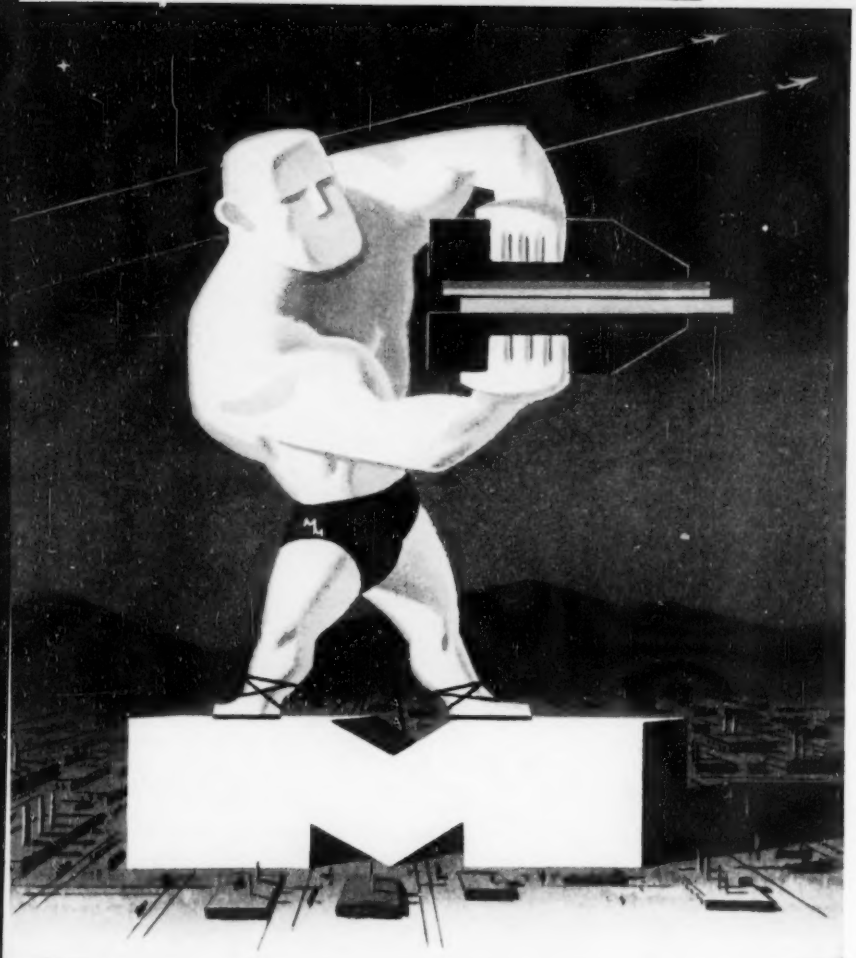
Mystere 4-B crashed near Paris Apr. 3 as the Dassault-built jet fighter dusted the ground in a highspeed sweep before top French and British defense officials, killing test pilot Constantin Rozanoff. Col. Rozanoff, 49, commanded the Lafayette fighting group in World War II and was the first French pilot to fly faster than sound in a plane produced in France.

Turkish State Airlines DC-3 exploded Apr. 3 shortly after taking off from Adana Airport for Ankara and Istanbul. All 25 persons aboard were killed.

Leon Schoevaerts, 56, vice president-sales for Sabena Belgian Airlines, died Apr. 1 at Brussels. Paul Stouffs has been appointed his successor.

Flight research on jet engine afterburners is being carried out by Canada's National Aeronautical Establishment at Ottawa in a Gloster Meteor loaned by Britain's Ministry of Supply. Knowledge gained from the "reheat" experiments is expected to be applied to powerplants for new fighters now on Canadian drawing boards.

Philippine Air Lines reports combined net profits of $819,398 for 1953 from gross revenues totaling $19,873,113, nearly double 1952's net and 17.4% higher than the previous year's gross of $16,928,119. Losses on PAL's international flight operation (AVIATION WEEK Mar. 1, p. 64) were more than offset by paper profits from the sale of aircraft and earnings from services performed for USAF.



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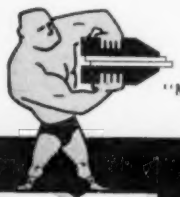

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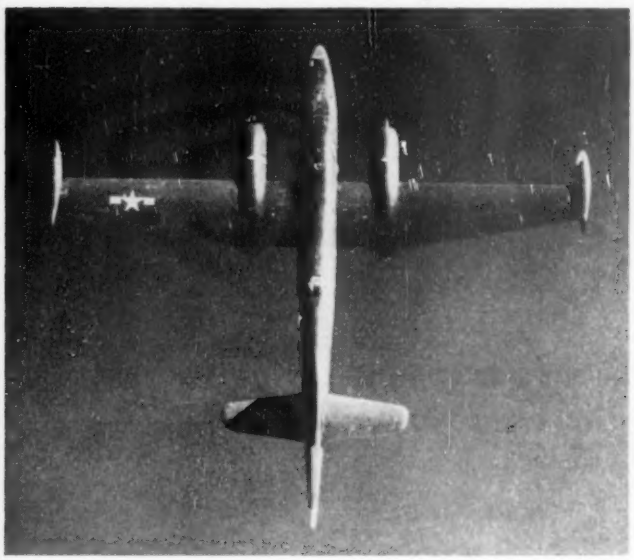
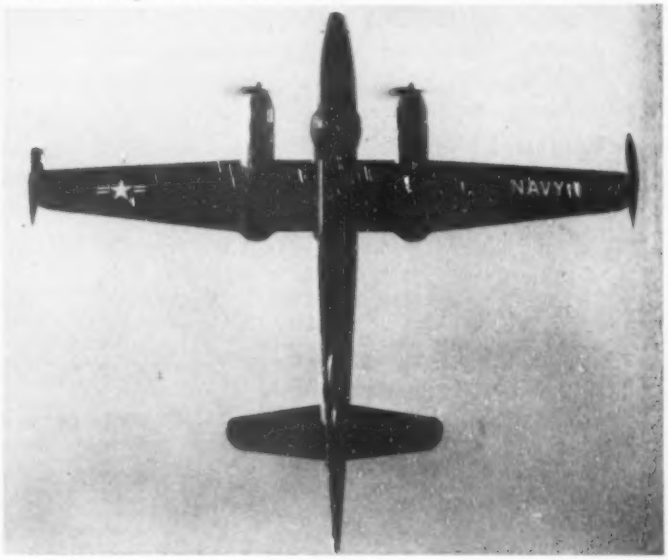
LATEST COUGAR—Grumman F9F-8 Cougar (P&WA J48-P-8), scheduled to enter fleet service this fall, is an improved F9F-6 featuring cambered leading-edge wing sections, more wing area, longer fuselage, greater fuel capacity and improved rear vision. The fighter first flew Jan. 18. The changes are intended to increase the Cougar's operational flexibility and improve its flying qualities.

New Navy Combat Planes on View

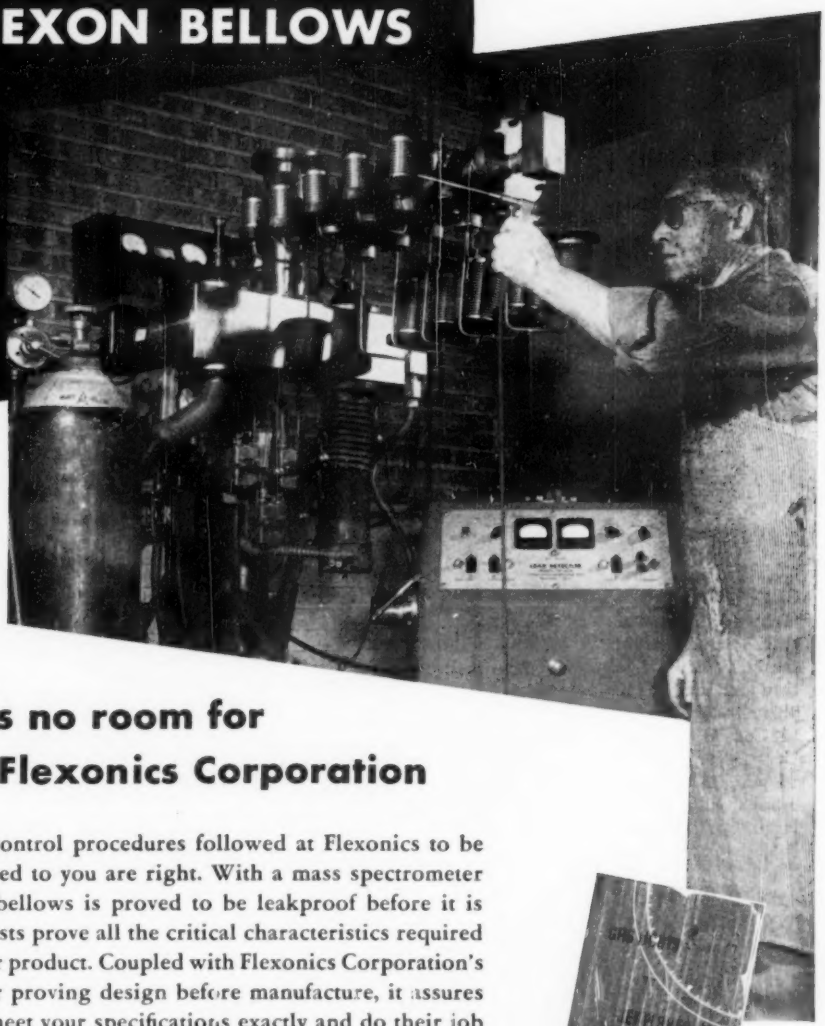
CROSS-COUNTRY SPEEDSTERS—Here (right) are three Grumman F9F-6 Cougars at Floyd Bennett NAS, N. Y., after crossing the U. S. nonstop from San Diego in less than four hours. Probes in noses enabled the planes to be refueled aloft. This is first view of Cougars fitted with air-refueling gear. Center plane (121) made the flight in 3 hr. 45 min. 30 sec.; Cougar at far right (122) 3 hr. 46 min. 49 sec., and plane at left (102) logged 3 hr. 47 min. Marks are unofficial.

TOP AND BOTTOM—Two unusual plan views (below) of Lockheed P2V-5 Neptune from above and below twin-engine anti-sub plane.





THIS MAN PROVES FLEXON BELLOWS BEFORE THEY GO INTO SERVICE



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WHO'S WHERE

In the Front Office

Junius H. Cooper has resigned as vice president-finance for Delta-C&S Air Lines.

Joseph F. Gentile, treasurer for Resistoflex Corp., and chief engineer **Irving D. Press** have been elected vice presidents of the Belleville, N. J., aviation equipment manufacturer.

R. B. Hutton is new vice president-sales for Leach Corp., Los Angeles. **James K. Dysart** has been appointed sales manager for Leach Relay Co., a division of the West Coast electronics producer.

James H. Binger, vice president-foreign operations for Minneapolis-Honeywell Regulator Co., has become a director of Northwest Orient Airlines. **A. D. Piepgras** has been promoted by NWA to assistant comptroller, and **D. H. Hardesty** is new assistant treasurer.

Drs. Dean E. Wooldridge and **Simon Ramo,** founders of Ramo-Wooldridge Corp., have been elected to the board of Thompson Products, Inc., Cleveland.

Changes

Harvey H. Stackman, Jr., has been appointed manager of Revere Corporation of America's industrial relations department, Wallingford, Conn.

William L. Gore has been promoted by Aerojet-General Corp. to sales director for the Azusa (Calif.) and Sacramento (Calif.) Divisions.

Marvin B. Ruffin has become director of customer relations for Summers Gyroscope Co., Santa Monica, Calif.

Charles F. McCabe and **Joseph H. Famme** are new assistant chief engineers for Convair's San Diego Division.

Frank L. Argall has resigned as sales director for Grand Central Aircraft Co. to rejoin Argall & Associates, aircraft, yacht and ship brokers, Hollywood, Calif.

Paul Ketelsen has been appointed aircraft sales manager for Meletron Corp., Los Angeles.

Joe Rosales has joined Pastushin Industries, Inc., Hawthorne, Calif., as works manager, supervising development and production of aircraft components.

Dan G. Gilmore is new assistant factory manager for Chance Vought Aircraft, Inc., Dallas. Also promoted: **Kelly G. Smith,** chief tool engineer; **Capt. Daniel N. Logan** (USN Ret.) and **Harold L. A. Uetrecht,** assistants to the factory manager.

Jeffrey Sidebotham has become contract administrator for Pastushin Aviation Corp., Los Angeles.

Jack K. Ayre, former publicity representative for Pan American World Airways, has been appointed to Panagra's public relations staff.

H. K. Coale is new director of mail service for Central Airlines.

Honors and Elections

Grover Loening, pioneer aeronautical engineer, is new chairman of the advisory council for Columbia University's Institute of Air Flight Structures.

INDUSTRY OBSERVER

►**Aeronautical research is barely keeping ahead of the demands of military aircraft, according to recent testimony of top scientists of the National Advisory Committee for Aeronautics before the House Appropriations Committee. NACA scientists say the gap between basic research and its application is now so narrow that many of the current generation of highspeed fighters literally have been engineered in the windtunnel.**

►Merger of Rome Air Development Center and the Air Force Cambridge Research Center under a single top command is being considered as a means of better integrating their air defense activities. Merger would not involve physical move of RADC facilities from present location at Griffiss AFB, N. Y. This substantial percentage of non-air defense work at both centers is currently an obstacle to the merger.

►**Lockheed F-104 lightweight fighter has made its first official flight, but Air Force, contrary to usual policy of revealing initial flights, will not let company make announcement or comment. Reports elsewhere that the F-104 flew the first of March were incorrect—plane was airborne only briefly during taxi tests.**

►First installation of Navarho, new long-distance navigation system which provides both bearing and distance information, will be made near the Rome Air Development Center. Navarho evaluation by civil and military agencies as a common system standard for U. S., and possibly worldwide use (AVIATION WEEK Apr. 5, p. 29), is expected to begin within 12-18 months. Contractors have USAF requests to bid on Navarho ground equipment.

►**Titanium alloy blades for turbojet compressor rotor and stators are now production items. Thompson Products, Inc., is making the units for U. S. engine manufacturers.**

►Allison's 3,750-eshp. T56 turboprop was first flown at end of last month as a nose installation in a B-17 flying test bed. Start of production buildup for the engine, slated for Convair C-131C and Lockheed C-130, is scheduled very soon.

►**Transocean Air Lines soon will flight test a pair of jet auxiliary powerplants on one of its C-46 Curtiss Commandos, according to industry observers. Installation will be similar to that made by El Al Israel Airlines on its fleet of C-46s (Aviation Week Aug. 10, 1953, p. 38). Purpose is to provide greater takeoff payload and safety in event of engine failure.**

►Royal Air Force is considering the use of Comet jet transports as aerial tankers for the Vulcan, Valiant and Victor bombers when BOAC replaces them with later model Comets.

►**Vickers-Armstrongs Aircraft Division reports an order for three Viscounts from Misrair, the Egyptian airline, bringing the total number of Viscounts sold to 91. Misrair expects to get delivery of its first Viscount in July 1955.**

►Civil Aeronautics Administration reports U. S. airlines had 408 transports on order as of Jan. 1, 1954, with 278 planes for delivery before July 1.

►**Air Navigation and Development Board traffic control simulator is now being used by CAA to develop and test new traffic control procedures for specific congested terminal areas such as Washington, New York, Chicago, Los Angeles and Miami.**

►First production F-102 was moved by truck last week from Convair, San Diego, to Edwards AFB. Other production models are on assembly line at Convair's plant No. 2.

►**Navy has a new design competition for a one-man helicopter that can be dropped from aircraft by parachute. Marines want this type of an air transportable copter for reconnaissance and communications work as part of their new helicopter vertical-envelopment tactics.**

Washington Roundup

Secrecy Debate

Defense Department's "secret" briefings do not give senators on Armed Services Committee as much information as is available in the nation's press, according to former Air Force Secretary, Sen. Stuart Symington.

"I get far more information, especially from weekly magazines and newspaper people, than I get in any briefings held in the Senate Committee on Armed Services," he told the Senate. "If senators cannot obtain the needed information in another way than by magazines, newspapers, and the radio, certainly it is better for them to know the truth in that fashion than merely to have the hope it will be given them by persons in charge of the armed forces, and by other government agencies."

Defense Department's "somewhat-less-than-candid attitude," Symington declared, "was highlighted several weeks ago, when the news broke—though not through the Defense Department—of the two new heavy bombers with which the Soviets are now equipping their long-range air force" (AVIATION WEEK Feb. 15, p. 12).

He concurred in press criticism that "it is plain dishonest for the Pentagon to go on smugly boasting about American air striking power without at least uttering a warning word or two now and then about Soviet air atomic striking power."

He described as "a masterpiece of evasion" a reply he received, after waiting several weeks, to questions he asked an unnamed member of the Joint Chiefs of Staff at a briefing session.

"Disagreements among the Joint Chiefs of Staff, implied before our committee," he stated, "are subjects which should not be dismissed in an effort to obtain a type of harmony, which harmony is nevertheless not in the best interests of the United States."

Sen. Wayne Morse commented: "It is a sad state of affairs, when a member of the Armed Services Committee of the Senate tells the American people . . . that in order to obtain information about the state of air defense of the U. S., he has to rely upon magazine articles. . . ."

Next Air Show

Air Foundation Inc., non-profit organization in Cleveland headed by Fred Crawford of Thompson Products, probably will return to Dayton for its 1954 air show. Defense Department will approve and cooperate with the Dayton show.

Meanwhile, Aircraft Industries Assn. will vote at its May 19-21 board of governors meetings at Williamsburg, Va., on official approval of an annual national aircraft show. Special committee headed by Ira Eaker of Hughes Aircraft has been studying the problem of AIA backing for an annual air show. AIA decision will come too late to affect the 1954 Dayton show.

Windtunnel Costs

If the Senate sustains the $3.6-million cut in the operating budget of the National Advisory Committee for Aeronautics voted by the House, operation of unitary plan supersonic windtunnels for the aircraft industry probably will face indefinite delay. First NACA-operated unitary windtunnels now are scheduled to begin preliminary operations early in fiscal 1955. They will require several hundred additional people and a large amount of electric power.

Air Force vs. Army Engineers

Elevation of the USAF Director of Installations to the status of Assistant Chief of Staff for Installations is viewed as a long step in Air Force efforts to direct its base construction program. USAF construction is now handled by the Army Corps of Engineers.

Maj. Gen. Lee B. Washbourne, a former Army Engineer, will report directly to the USAF Chief of Staff instead of working under the Deputy Chief of Staff for Operations. His position is now comparable to the Army's Chief of Engineers.

Official reasons for the change:

- Installation program was falling behind the aircraft and personnel procurement programs in the Air Force expansion, and additional emphasis on base construction and improvements was necessary to insure efficient completion of the 137-wing program.
- Change will permit more effective administration of the Air Force's $7-billion construction program and will reduce the workload of the Deputy Chief of Staff for operations.

The Corps of Engineers, which recently relinquished control of aviation engineers to the Air Force, appears to be on the run. But Washington observers are not selling the Army Engineers short in their fight to retain operational control of the huge USAF construction program.

Reason: The Army Engineers, generally conceded to be the most powerful lobby in Washington, are in charge of a nationwide program of flood control and inland waterways—the "pork barrel" bill—a grass-roots source of political power.

Army Engineers exercise a potent influence over Congress because of their authority to decide the "economic feasibility" of such projects. Unification Act assigns USAF construction to the Army Engineers, and a change presumably would require congressional action.

MATS Reorganization

USAF has completed its plan for reorganization of the Military Air Transport Service and submitted it to Defense Secretary Charles E. Wilson for approval. There is no indication yet whether Defense Department will accept the USAF plan.

National Airport Proposal

Airline officials have had their first look at Commerce Department's proposed bill to reorganize and incorporate Washington National Airport. Reactions have been mixed, but a majority is concerned that such a bill, if passed by Congress, could mean doubling their costs for use of the airport facilities.

Based on the Hoover Commission's 1949 recommendation, the measure would provide a basis for using revenues from users of the airport to meet the cost of the operation.

The bill would bring in a minimum addition of $700,000 annually above the $1.5 million received during each of the past several years.

Budget Bureau has tentatively approved the bill pending consideration by the carriers involved. Chief opponents to the measure are expected to be Allegheny Airlines and Capital Airlines, both headquartered at Washington National.

—Washington staff

AVIATION WEEK VOL. 60, NO. 15
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Air Force Develops New Production Plan

- **Initial production is held down, but accelerates after tests have ironed out bugs in delivered aircraft.**
- **Cook-Craigie program is expected to cut costs and set up technically sounder development of output.**

By Robert Hotz

A new production program is being applied by the Air Force to virtually all of its new aircraft scheduled to be built in quantity.

Known informally as the Cook-Craigie procurement plan and formally as the Initial Low Rate of Aircraft Production Plan, it is designed to provide for a less expensive and technically sounder development of an aircraft production program in about the same period of time as formerly required.

▶**F-102 Production**—Both the Boeing B-52 bomber and the North American F-100 fighter were put into production under modifications of this plan, but the Convair F-102 interceptor is the first USAF aircraft completely scheduled under the program.

Other new aircraft now in early phases of production coming under the new plan include: McDonnell F-101 long-range penetration fighter and the Douglas C-133 and Lockheed C-130 turboprop transports.

▶**Low-Level Output**—Basic feature of the new production program is holding output to a relatively low level (less than five a month) for an 18-to-24-month period while an extensive test program is conducted on the aircraft delivered. This test program is aimed at working out major bugs in airframe, engine and major components as quickly as possible so that any modifications required can be cranked into the accelerated production program.

Under the new plan, the accelerated production program will not begin until the end of the 18-to-24-month intensive test period. The length of the initial low production period will vary with the type of aircraft.

For example, an off-the-shelf-type transport or trainer will require very little testing; new fighter types representing large technical advances will require about 18 months, while new bombers may go beyond 24 months.

▶**Replacement**—This new program replaces the old development-production cycle that began with the hand-building of experimental prototypes, flight testing and then tooling for quantity production.

During the press of international crises, this cycle frequently was compressed so that production was begun almost before an experimental prototype had time to fly. As a result, hundreds of an aircraft type were produced before the flight test program uncovered defects that would require major modifications.

The only choice when this developed was the retro-fit modification program that consumed time and money on a large scale and often resulted in grounding combat groups already equipped with the defective aircraft.

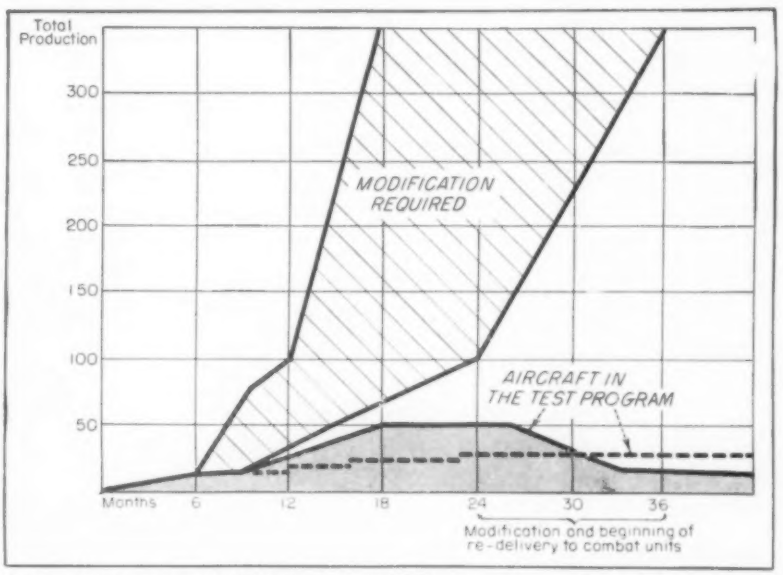
▶**Windtunnel Work**—The new cycle eliminates experimental tooling, prototypes and drawings. First aircraft are built with production-type tooling from production drawings. One of the reasons this now is possible is the extensive windtunnel facilities available for private aircraft contractors.

By doing a major portion of the engineering of new designs in company and government-operated windtunnels, it is possible to get an initial flight article that performs extremely close to engineering specifications developed from windtunnel work.

▶**Tests Complex**—Beginning production tooling from the first phase of the development production cycle saves about 18 months' time in tooling over the old method. This time is devoted to building aircraft primarily for an extensive and accelerated test program. Modern aircraft now are so complex that instead of a pair of experimental prototypes formerly used, nearly 50 aircraft are necessary for a complete test program.

With the process of production tooling, low-rate production and flight testing taking place simultaneously, it is possible to reach a decision toward the end of the low-rate production period:

• Whether the large-scale production program should be scrapped because of



OLD AND NEW PRODUCTION SCHEDULES are compared in this chart. First heavy black ascending line indicates old method of production acceleration after a new plane has started tests. Second bold ascending line indicates acceleration rate under new system. The diagonally lined area between the two bold lines indicates the number of aircraft built under the old system that would need modification before attaining combat-ready status.

technical deficiencies in the aircraft or its equipment.

• What modifications will be required for the large-scale production.

• When this program can begin to deliver combat-ready equipment to tactical units.

► **F-86 Gamble**—Under the old method of production, it was possible to produce a large number of aircraft in the 18-to-24-month period of initial production, but usually most of these aircraft were not combat-ready and had to be sent through a modification center before they were ready for tactical use.

One of the major exceptions to this rule was the F-86 when USAF gambled on volume production of a technically advanced aircraft type and emerged with a relatively bug-free, highspeed fighter in sufficient quantity to at least hold off the Russian MiG-15 in Korea.

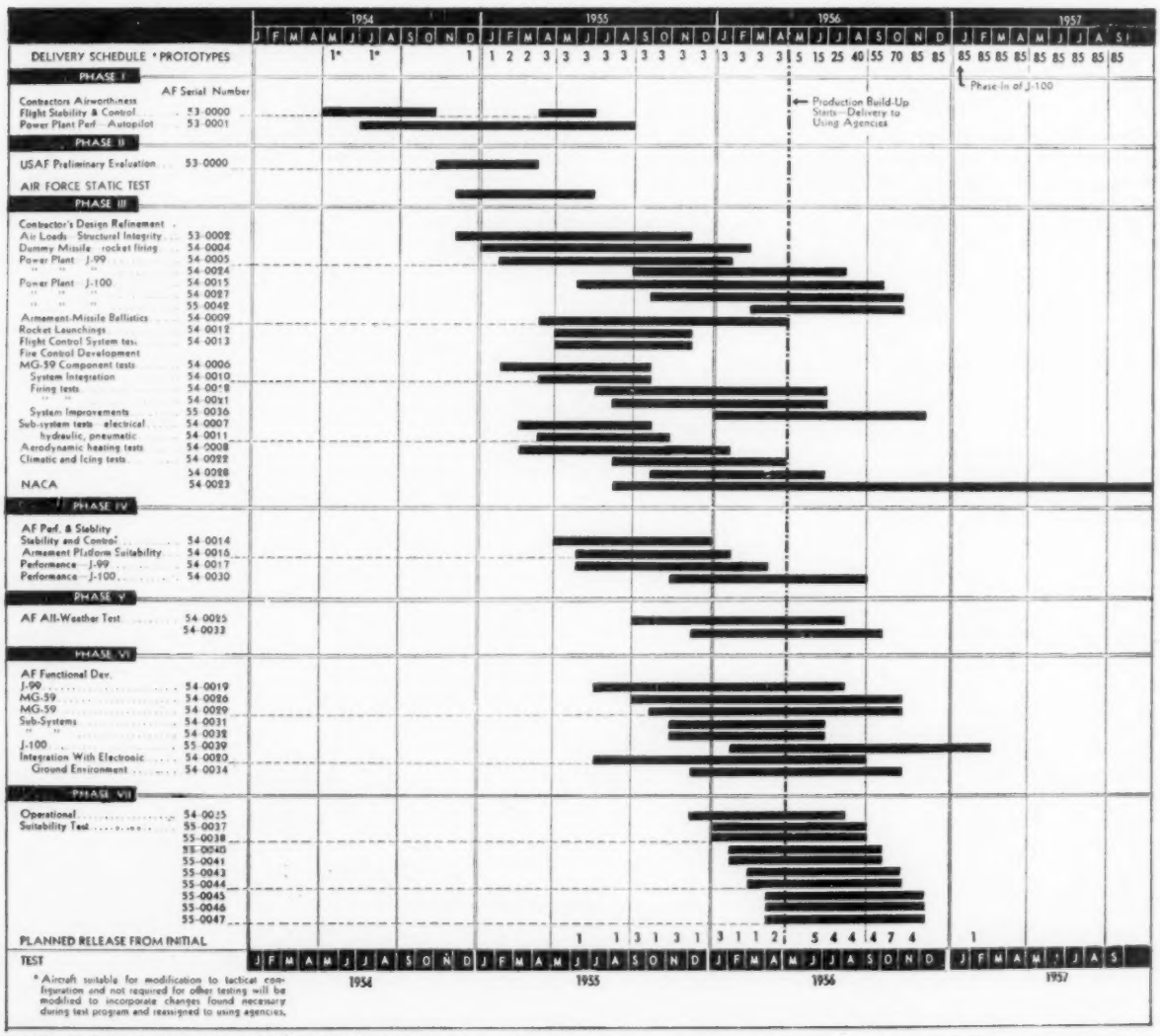
In the new program, USAF regards its research and development money expended on new aircraft types as essentially risk money. By keeping initial production low until sufficient actual performance data can be obtained, it avoids risking large quantities of production funds on steel speculative products.

► **'Resole Old Shoes'**—Under the new system, if USAF decides to abandon a project before accelerated production begins, it has lost only its development money and some production tooling costs.

But under the old system, USAF already had accumulated a large production inventory of unusable items by the time technical deficiencies become apparent and the tendency was to try to "resole old shoes" with a modification program instead of washing out the program and switching money to more promising developments.

The slow initial production plan provides USAF with a method of developing new aircraft and its equipment on a technically sounder and less expensive basis within the same time period and also provides a basis for fast expansion in event of emergency. For example, while the F-102 is scheduled for relatively low-rate production for some time ahead, bulk of production tooling already has been installed and in event of an emergency the production rate could be shifted into a swift climb without any of the major problems that characterized the post-Korean production acceleration.

► **Definite Goal**—Another advantage for USAF is that in the current period of a buyers' market for military aircraft, it gives the military a better opportunity



HOW SLOW INITIAL PRODUCTION PROGRAM would apply to a new interceptor is shown in this chart, defining test program for various components. Plane is the imaginary F-199 supersonic interceptor. The F-199's theoretical fire control system is designated MG-59. Because of promising progress in turbojet engine developments, the F-199 is shown to be initially powered by the imaginary J99 engine but later phases into the J100 when acceleration of production starts.

to evaluate new products before committing large-scale production funds.

USAF also believes the plan will give the contractor a more definite goal toward which to direct his planning on new equipment programs and will result in a more stable operation for the aircraft industry.

▶ **Orderly Cycles**—It also will prevent both the prime contractors and subcontractors from accumulating large inventories of unusable tooling, material and parts made obsolete by the "crash" modification programs of the past. Under the new program, initial modifications will be made during the low-volume production program. Generally, this type of modification does not involve basic tooling changes.

Modification programs of the future are expected to be orderly cycles of installing "state of the art" improvements into aircraft types at regular intervals in order to prolong their life in the active USAF inventory.

The initial low-rate production plan was developed about three years ago as part of the USAF "new look" at its development and production problems on new weapons systems.

Gens. Laurence Craigie, Donald Putt and Orval Cook generally are credited as being principally responsible for activating the plan.

Human Factors

Man Still Superior to 'Gadgets'

Aero Med meeting hears how ARDC tailors a weapon such as the B-52 to human capabilities and needs.

Human beings cannot be displaced by gadgets at the present time for the operation of major air weapons systems, Col. Don Flickinger told the 25th annual convention of the Aero Medical Assn. in Washington, D. C.

Col. Flickinger, director of research for the USAF Air Research and Development Command, said the human being still is superior to electro-mechanical gadgets for operating air weapons because of lower cost, less weight and more technical "know-how."

▶ **Vital Link**—"The tremendous advances made in aeronautics and electronics have greatly increased the operational potential of the manned aircraft system but, at the same time, have made the crew member a link of more vital importance to the system than ever before," he said.

"Accepting this essentiality of the human element, we additionally must accept the necessity for careful planning towards his optimal integration into the total weapons system. . . . Any performance capability researched and engineered into the hardware of a weapon which is over and above the capability of the crew member to use is wasted, not only in terms of potential advantages over the enemy but also in terms of scientific and technical effort."

▶ **Human Engineering**—Flickinger described the work of a specific ARDC human factors team assigned to the Boeing B-52 Stratofortress as an example of how human engineering is applied to a specific weapon. The human factors team for a specific weapon is organized about six to eight months before the formal mockup time on the weapon and is charged with complete responsibility of conducting the pre-mockup human factors technical inspection.

A typical human factors team is headed by a flight surgeon, physiologist or rated engineering officer and has the following members: anthropologist, physiologist, bio-physicist, personal equipment officer, aircraft contractor representative, and a representative from USAF command scheduled to use the weapon. Observers from ARDC Human Factors Directorate, USAF Flight Test Center, Flight Safety Directorate and subcontractors are assigned to work with the team.

▶ **Early Detection**—As a result of the human factor studies made on the B-52 and its crew operations, a number of deficiencies were uncovered that formerly would have gone uncorrected until they appeared much later during actual operational use of the plane.

Most of the defects could be corrected by the contractor without delaying production schedules or increasing costs, and 85% of the human factors team recommendations were incorporated in the B-52 by Boeing engineers despite the fact that the full-scale inspection was made after formal mockup inspection had been finished and production of the aircraft had begun.

FLICKINGER: Man is the vital link.

Among the changes made in the B-52 for human factors considerations were:

• **Warning bell for emergency escape.** With the pressure helmet on, the old system of using an auditory signal to signal an emergency bailout situation no longer is adequate because, with the pressure suit helmet on, the crew member cannot hear the signal.

Corrective action: Installation of a blinking red light in plain view of the crew member to provide visual orientation of the emergency.

• **Relocation of instruments.** Some of the mission's critical instruments, such as PDI, were visible optimally to the pilot but not the co-pilot. If for any reason the pilot were rendered nonfunctional, the co-pilot would have difficulty completing the mission from the right-hand seat.

Corrective action: Central panel location of these indicators, where both the pilot and co-pilot can see them equally well.

• **Crew movement in walkways.** It was noted that crew members with flight gear on had considerable difficulty getting through the various walkways between various compartments. Under normal or emergency conditions, this delayed movement of the crew within aircraft could lead to loss of life or unnecessary loss of aircraft.

Corrective action: Provide suitable hand holds strategically placed in walkways to provide means of propelling oneself from one space to another. Elimination of sharp corners and edges that might cause crew injury in rapid movement through walkways.

• **Tail gunner's work space.** The work space of the tail gunner was so designed that he had extreme difficulty in getting in and out of his seat with required equipment on. In addition, he could not look into the scope and at the same time operate the control handle freely due to impingement of knees on control handles. This restricted his freedom of movement and materially reduced his functional efficiency in performing the job. Cramped position predisposed to early fatigue and made it extremely difficult to get out of his station under emergency conditions, by any means other than jettisoning the tail cone.

Corrective action: Repositioning of seat and gun mount with recessing of surrounding components.

• **Radar control accessibility.** The adjustment controls for the synchronizer and pedestal amplitude in the SN-47/APS-23 were situated too far away from

the bombardier, requiring him to unfasten the seat belt and get out of his seat in order to adjust these controls. While adjusting them he could not look simultaneously at the face of the radar scope. In addition to being a very poor functional arrangement, it created a slight hazard to the crew member in that he is temporarily out of his ejection seat and appreciable time would be required to reinstate and readjust himself back into position ready for emergency ejection.

Corrective action: Relocation and redesign of controls.

▶**Functional Effectiveness**—Col. Flickinger said experience gained by human factors team activities on the B-47, B-52, F-86, F-100 and other weapons systems indicates that, no matter how carefully each individual crew member is studied, the true and final evaluation of total crew capability to operate the system as required cannot be accomplished prior to the pre-mockup inspection.

At that time, an actual crew with full equipment must be checked out on a closely simulated operational mission to determine their functional effectiveness both as individuals and as a total team.

▶**Changes Practical**—With the exception of structural changes in the basic airframe or major components, experience also has indicated it almost never is too late to incorporate some alleviation of an undesirable crew situation, provided the basic human factors data for the change exists in a form the contractor can apply and there is unanimous agreement between ARDC, the using command, and the contractor on the need for the change.

Flickinger reviewed the progress made to date in developing human factors work by ARDC and applying it to the entire development cycle of the weapons system. He cited the following major deficiencies still remaining in human factors work:

- Lack of fundamental data in the human factors field that is available to engineers in usable form.
- Lack of a comprehensive plan for collection, accumulation and dissemination of data to working groups of scientists and engineers.
- Lack of training programs, either military or academic, directed toward greater integration of common knowledge and skills required by life and engineering scientists to prepare them for work in the highly complex field of man-machine optimum performance.

Airpower Fight

- **GOP senator challenges Democratic criticism.**
- **Ferguson says buildup 'making real headway.'**

The congressional airpower fight has moved forward with a rebuttal by Republican Sen. Homer Ferguson to a speech by Democratic Sen. Stuart Symington criticizing the Administration for delaying two years the attainment of a 126-wing combat force, (AVIATION WEEK Apr. 5, p. 10).

Ferguson, chairman of the Military Appropriations Subcommittee, declared:

"Any belief that our air readiness has been delayed two years, or that we could have had 143 wings (126 combat and 17 transport) by June 30, 1955, is based on the dreams of three years ago and not on the realities of the situation then, or any time since then. What we have now is a solid program which is making real headway."

▶**Obligation Criteria**—Ferguson said the fact that USAF has made a net obligation of only $100 million against its procurement funds since the start of fiscal 1954 last July is due to considerable extent to a more rigid criteria as to what constitutes an obligation.

"During past years the anticipation of an obligation was in some cases sufficient basis for the Air Force to record the amounts as if they were actually obligations—in other words, contracted for," he said. "During the past months, it has been necessary to delete from the obligation records many of the amounts previously recorded as obligations."

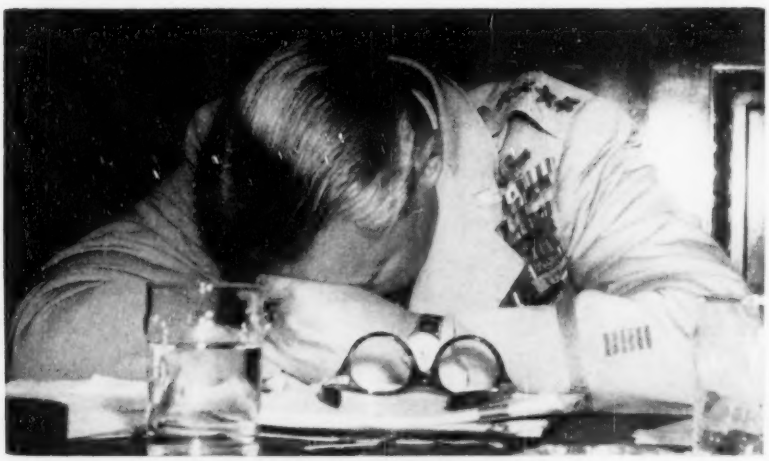
Ferguson challenged Symington's statement that, although the Soviet air force is now more than one-half jet-equipped, "under the Administration's new airpower program, our own air units—Air Force, Navy and Marine—will not be 50% jet-powered until 1957, three years from now."

▶**Cancelation Explained**—The GOP senator declared: "Our Air Force combat wings today are 80% jet-equipped and will be 94% jet-equipped by the end of fiscal 1955. Similarly, the Navy and Marine fleet combat units are currently 50% jet-equipped and this proportion will increase materially during the next several years."

Cancelation of 965 planes, Ferguson reported, "was made by the Air Staff of the Air Force because the planes were found to be excess of the needs of a full 143-wing program. In short, the program was not properly arranged.

"The bulk of the funds which had been programmed for the planes eliminated has been channeled into increased procurement of our latest and finest long-range heavy bomber, the Boeing B-52, and the most advanced day fighter that is ready for production, the North American F-100, a faster, more powerful version of the F-86. The balance of these funds will be used for the procurement of even more modern aircraft."

Ferguson said Symington's view "are in direct conflict with the President and chairman of the Joint Chiefs of Staff, and I, for one, intend to place reliance on their views."



General Vandenberg Dies

The Air Force lost one of its greatest officers with the death Apr. 2 of former USAF Chief of Staff Gen. Hoyt S. Vandenberg at the age of 55 following a long illness. This memorable prize-winning newsphoto shows a tired Vandenberg catching a brief rest at a Senate Appropriations Subcommittee hearing in Washington June 3, 1953, during which he challenged the new Administration's plans to cut down and stretch out what he termed the "one shot" 143-wing USAF program. Funeral services for Vandenberg were held in Washington's National Cathedral with President Eisenhower leading the host of attending officials. Burial was in Arlington National Cemetery with formations of F-84 and B-47 jets overhead in final tribute. His term as USAF Chief of Staff from April 1948 to June 1953 climaxed a 30-year military career.

New Copter Firm

- **Fairchild adds American Helicopter as division.**
- **Plastics, pulsejet projects are included in purchase.**

Purchase of American Helicopter Co. by Fairchild Engine & Airplane Corp. (AVIATION WEEK Mar. 1, p. 7) gives the transport plane builder an entry into the U. S. Army Transportation Corps' expanding copter development lineup.

American Helicopter, now operating as a division of Fairchild E&A, also provides the company with interests in development of wingtip-mounted copter powerplants, stainless steel honeycomb structures and fibrous-glass reinforced plastics—keynoting Fairchild's continued diversification.

Last November, Fairchild acquired the Speed Control Division, which makes speed and torque control devices for industrial machines. The firm long has operated missiles, aircraft accessories, engine and airframe divisions.

▶ **Pulsejet Copters**—American currently is producing five XH-26 single-place pulsejet-powered copters for the Army, with delivery scheduled for fall of 1954.

The new Fairchild Division also is developing a rotor powerplant system for an 8,000-lb.-payload cargo helicopter, involving study of a pulsejet engine and complete preliminary design of a copter meeting Army's requirement for a three-ton-payload aircraft (see artist's sketch).

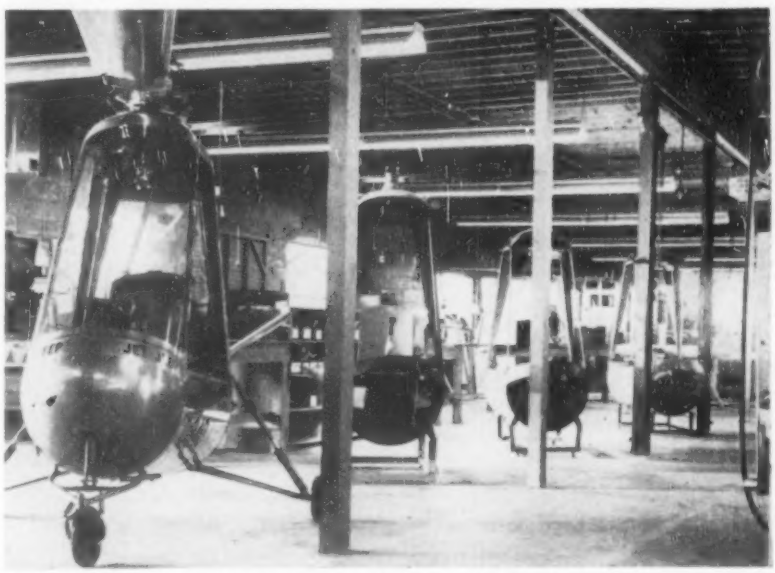
▶ **Prime Contractor**—The copter builder has three facilities totaling 80,000 sq. ft. General administrative and engineering offices are at Manhattan Beach, Calif.; plastics development is handled at Costa Mesa, Calif., and powerplant whirl test activities are concentrated at Mesa, Ariz.

The firm has been an Air Force prime contractor in copter and engine development since 1949.

Corwin D. Denny, formerly president and general manager of AHC, has become general manager of Fairchild's American Helicopter Division, and Howard E. Roberts, vice president-engineering, continues as director of operations.

THREE-TON PAYLOAD COPTER is one of design projects of new Fairchild division.

XH-26 JET COPTER, designed by American Helicopter Division, undergoes flight tests.



XH-26 OUTPUT at Fairchild's American Helicopter Division, Manhattan Beach, Calif.

Airlines Delinquent On AF Gas Payments

Senate Armed Services Subcommittee investigation has learned that 18 airlines were on USAF books on Apr. 1 as delinquent in amounts of $1,000 or more. The Senate hearings disclosed that in many cases USAF was not aware of what airlines owe it money for fuel purchases (AVIATION WEEK Apr. 5, p. 15).

The firms listed as delinquent:

Continental Charters, $30,327; Miami Airlines, $16,616; Federated Airlines, $5,684; U.S. Overseas Air-

lines, $45,131; U.S. Airlines, $142,496; Connor Air Lines, $64,004; Lake Central Airlines, $38,186; Regina Cargo Lines, $1,860; West Air Transport, $2,951.

Associated Air Transport, $12,563; Great Lakes Airlines, $1,464; North American Food Carriers, $12,885; Economy Airways, $7,416; Peninsular Air Transport, $1,746; Air Transport Associates, $7,211; California Air Charter, $1,504; Meteor Air Transport, $10,718; S.S.W., $9,988.

PAA Expects Credit Plan to Boost Traffic

Pan American World Airways expects a 25% increase in passenger traffic this year as a result of its new "pay later" plan, whereby aircoach passengers are permitted to pay for tickets in monthly installments (AVIATION WEEK Mar. 29, p. 7).

Scheduled to go into effect May 1, the plan will cover flights from the U. S. to any of the 83 countries served by Pan American or its affiliated companies. A 10% down payment buys the ticket, with the balance payable over 20 monthly installments.

Financing may cover all charges on an international tour, or on the air fare alone. On pre-arranged tours, it may include surface transportation, hotels, special accommodations and sightseeing.

▶ **Air Travel Bid**—Several factors influenced PAA's adoption of such a plan, says Willis G. Lipscomb, vice president traffic and sales:

- **International travel** has not been attracting its fair share of the consumer's disposable income.
- **Travel competes** for the consumer dollar with automobiles, television sets, home appliances and other such luxury items—all merchandized on a time-payment plan.
- **Installment buying** has become an integral part of the American economy in almost all phases of consumer buying.

Aerojet Buys French Jet Thrust-Reverser

Aerojet-General Corp., Azusa, Calif., has completed a licensing agreement with Snecma to build the French engine manufacturer's jet thrust-reversing device in the U.S.

The Snecma thrust-reverser is applicable to any turbojet engine, Aerojet says, and is designed to stop a jet plane in about half the distance normally required.

Former Secretary of the Navy Dan Kimball, now Aerojet-General president, says, "This thrust-reverser provides a companion product to our already developed jet-assist takeoff unit for safe aircraft takeoffs."

Briefly, the Snecma unit uses an air blast piped from the plane's compressor to divert the jet flow into annular baffles, which complete the reversing system. The unit is completely retractable and controllable by the pilot (Earlier details of the Snemca device were carried in AVIATION WEEK June 8, 1953, p. 40 and Jan. 25, p. 58).

Snemca has flight tested its thrust-reverser in a de Havilland Vampire jet fighter powered by a DH Goblin.

Several other companies, notably Boeing Airplane Co. and de Havilland, are known to be developing jet reversal units for braking purposes.

C-46 Fixes

- **CAB submits two plans for air industry study.**
- **ATA favors $65,000 modification proposal.**

Civil Aeronautics Board last week submitted two proposals for modification of Curtiss C-46 aircraft to the aviation industry for comments before deciding which will be approved for certification of the transport.

Industry will have a chance to study the proposals of Aircraft Engineering Foundation, estimated to cost $15,000 for each C-46, and that of Air Carrier Engineering Services, expected to cost approximately $65,000 per airplane.

▶ **ATA Backs ACES**—AEF, an organization of 31 operators owning 110 C-46s, has been studying the modification problem at Los Angeles, since last August with cooperation of Civil Aeronautics Administration.

Air Transport Assn. is backing the ACES proposal, which it finds more effective in revamping the C-46 to meet current safety requirements.

ATA is interested in the C-46's future because Resort Airlines, a member, has nine of the transports in operation and is interested in the Miami company's modification.

▶ **Waiver Seen**—Norman H. Golden, vice president of ACES, says his modified C-46 meets the Civil Air Regulations requirements except for the paragraph "which requires a windshield that will stand, without penetration, the impact of a four-pound bird when the airplane is operating at maximum cruising speed."

ACES points out this is not a requirement for the Douglas DC-4 and Lockheed Constellation and, "since there have been to our knowledge no C-46 mishaps caused by a collision with a bird, it is felt that this paragraph can be waived with no resultant decrease in safety standards."

CAB has extended until July 1 the exemption of the C-46 from recertification requirements under the transport category of CAR. A previous exemption expired Mar. 31. Industry probably will be given until July 1 to comment on the proposals submitted.

▶ **Tests Scheduled**—AEF has been flight testing its modified C-46 since Mar. 15 at Los Angeles. It will be ready for certification tests in about two weeks. CAA Administrator Fred B. Lee, on a recent visit to the coast, checked out in the airplane.

Golden says the ACES C-46 will be ready for flight testing by mid-May.

AEF recommends that all C-46 aircraft used in commercial service comply with its modification rules by Mar. 31, 1955.

▶ **Differences**—Big difference between the two proposals is the modification of the engines and nacelles. AEF has modified the nacelle in order to add new methods of engine cooling and fire protection. This gives each engine (Pratt & Whitney Aircraft R2800-75) from 5% to 8% more power, AEF finds.

ACES proposes to replace the R2800-75s with the R2800-34s, also powering the Convair 240 and Douglas DC-6, in addition to modification of the nacelles. The Engineering Service figures the engines can be purchased, modified and installed for $15,000 each.

The Miami firm also wants to replace the C-46's two propellers with the Hamilton Standard 33E60/68899-9 for better performance and less vibration. Cost for two props will be $7,500.

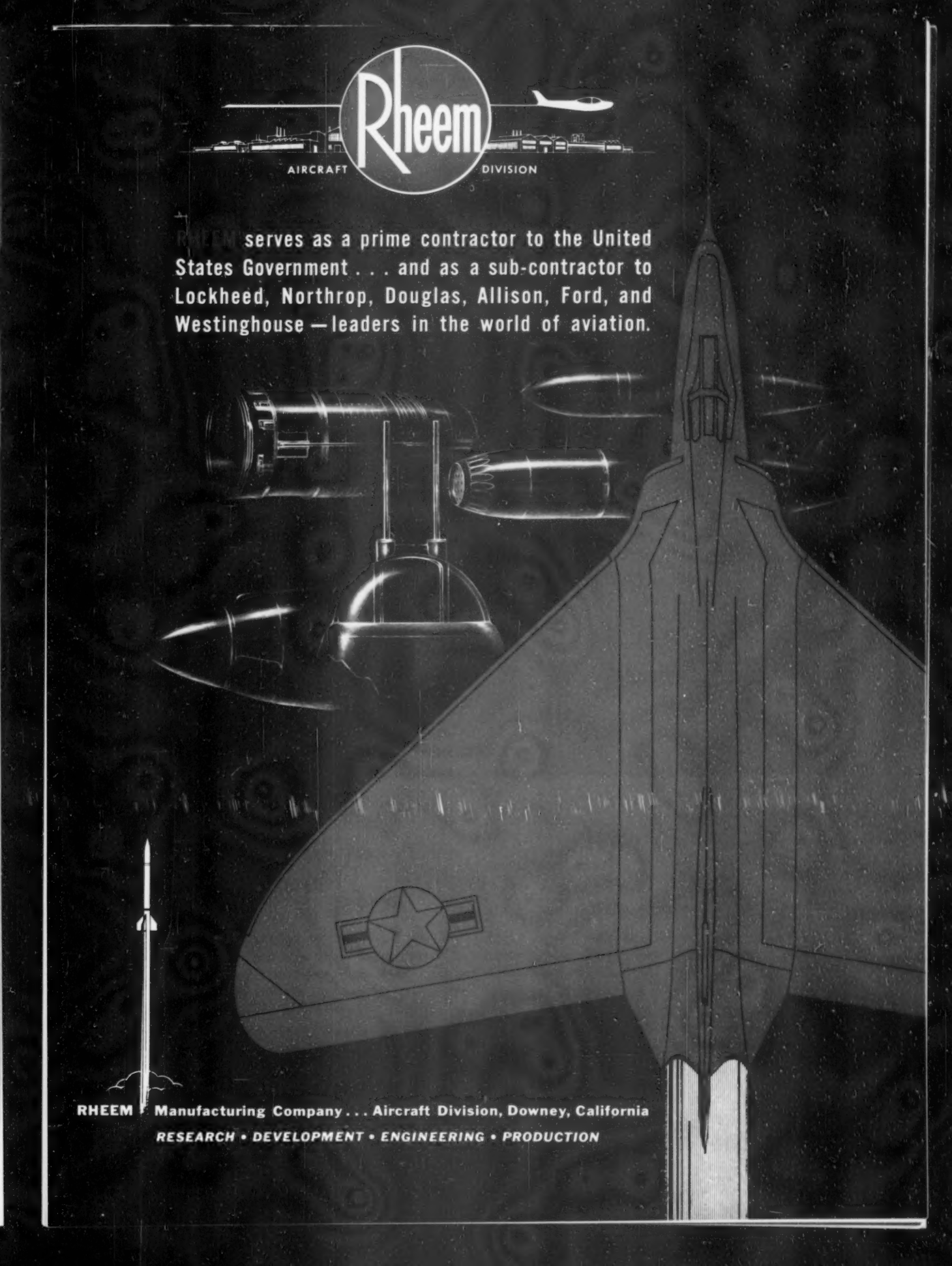
In addition to the companies here and abroad that operate the C-46, USAF is vitally interested in the modification proposals. Air Force owns 370 C-46s.

CAA Studies Viscount For U.S. Certification

Preliminary certification studies of the Vickers-Armstrong turboprop Viscount are being made by Civil Aeronautics Administration technicians while awaiting an invitation from British Air Registration Board to send a team to England for a complete investigation.

Trans Caribbean Airways asked CAA to certificate the British transport since TCA is in the process of ordering two Viscounts at a cost of about $750,000 each. The irregular airline plans to operate the transports over U. S. routes, requiring CAA certification.

Trans Caribbean president O. Roy Chalk has received a contract from Vickers for delivery of the Viscounts in early fall of 1955. He plans to go to England in May to conclude negotiations.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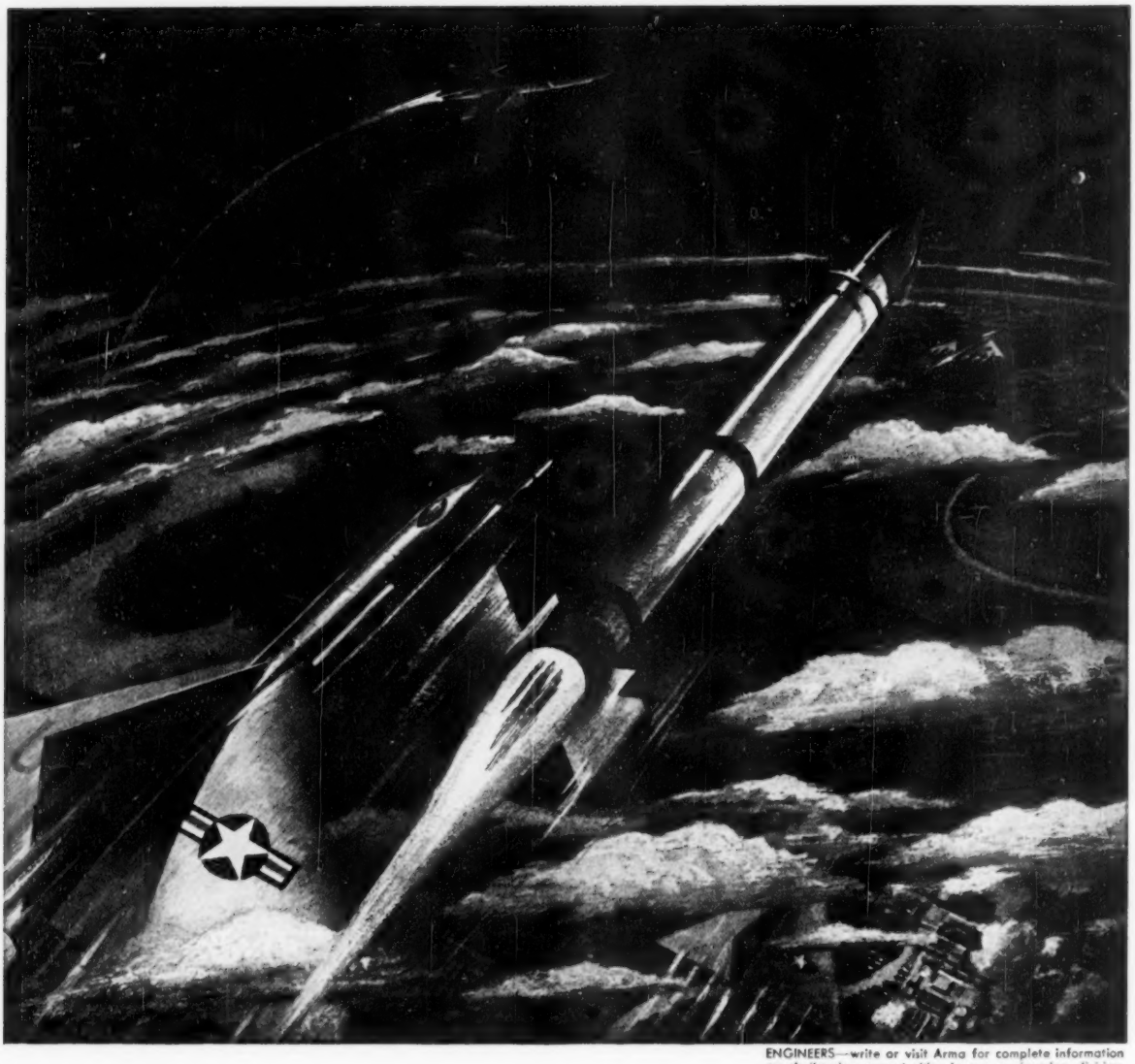

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1953 Annual Reports

Company	Sales 1953	Sales 1952	Backlogs 1953	Backlogs 1952
Bell	$146,929,791	$129,154,375	$456,800,000	$446,000,000
Boeing	918,245,946	739,010,214	2,357,000,000	1,648,000,000
Convair	370,703,232	390,997,843	1,000,000,000[1]	1,000,000,000[1]
Curtiss-Wright	438,728,482	326,183,643	771,750,000[2]	730,500,000
Douglas	874,515,463	522,619,409	2,214,000,000	1,840,000,000
Fairchild E&A	170,541,543	142,023,910	321,000,000	310,000,000
Lockheed	820,467,000	438,122,000	1,408,808,000	1,608,669,000
Martin	208,006,538	143,999,382	550,000,000[1]	660,000,000[1]
North American	634,688,156	315,270,855	958,000,000	1,014,000,000
Republic	411,810,885	412,235,088	1,000,000,000[1]	1,000,000,000[1]
United Aircraft	817,557,395	667,769,234	1,500,000,000	1,460,000,000

[1]Approximate.
[2]Total unfilled orders, plus scheduled production under letter contracts, exceeds $865,000,000.
Source: Company annual reports.

Reports Reveal Air Industry Gains

Annual statements point up sharp climb in production and sales, tell progress on new military projects.

Continuing production gains achieved by the U. S. aircraft industry last year are reflected in a sharp upswing in 1953 sales noted in annual reports recently distributed by Boeing Airplane Co., Lockheed Aircraft Corp., United Aircraft Corp., Curtiss-Wright Corp., Glenn L. Martin Co., and Bell Aircraft Corp.

By far the biggest jump recorded over 1952 by any of these plane builders was marked by Lockheed, reporting a nearly two-fold increase in dollar sales last year: a record $820,467,000, compared with 1952's $438,122,000.

Boeing's sales neared the billion-dollar mark, totaling $918,245,946. The previous year's sales were $739,010,214. Highlights from the annual reports:

• **Bell Aircraft** delivered its 1,000th helicopter in 1953, and before the year's end its copters logged more than a million flying hours in more than 40 countries.

Model 47G was approved by Civil Aeronautics Administration for 600-hr. operation between major inspections. The Navy HSL-1 anti-sub copter assumed the dominant role at the Fort Worth Division. Parts were procured and construction started on the XV-3 convertiplane prototype.

The company used 382 outside subcontractors to build $17 million worth of components. An electronic remote control system, developed by Bell and used on the Chance Vought Regulus guided missile test program, has permitted as many as 15 safe test flights on a single Regulus, saving millions of dollars on these ordinarily expendable units.

Bell received two important liquid-fuel rocket engine contracts from two major missile builders last year. The majority of the firm's work is on complete systems embodying rocket chambers, propellant tanks, all control systems, turbine pump, valves and all propellant lines from tanks to the engines. Rocket engines were produced on a quantity basis and included one, two and three-chamber units.

• **Boeing Airplane** currently is studying a requirement for a second highspeed windtunnel capable of higher ranges than its current transonic and low-supersonic facility.

Production-wise, the company's largest single program in terms of dollar sales involved the B-47 Stratojet, of which more than 600 were delivered from Wichita in 1953. B-47 production rates, which achieved their peak last year, will drop slightly this year.

A contract to initiate production design of the Boeing F-99 Bomarc pilotless interceptor has been received.

Future development of a broader market for Boeing's small turbine, now entirely military, is under study. The amount of money and effort to be devoted to this facet of the firm's activities is being evaluated.

• **Curtiss-Wright** spent $46,974,335 on research, development and engineering activities, compared with 1952's $35,695,098.

New orders last year brought to 10 the number of airlines using C-W electronic equipment, and the Simulator Division's backlog climbed to the highest in its four-year history.

The Propellor Division has received a contract for a new piston-engine propeller, which it is putting into production this year.

Orders for the Wright Turbo Compound piston engine brought to 25 the total number of airlines using the powerplant. The J65 Sapphire went into service operation on USAF planes during 1953, with production scheduled for four military types in addition to use in four other classified planes.

• **Lockheed Aircraft** has orders for 88 Super Constellations with spares and plans to deliver the transport to 17 airlines in 1954 and 1955.

Production of the all-weather, semi-automatic F-94C Starfire jet fighter will be completed this spring, leaving the company without a fighter in production for the first time in 15 years. The XF-104 area superiority type is undergoing evaluation. P2V output will continue through 1955 at a declining rate, and T-33 trainer production is scheduled through 1955.

The company says it has spent 110,000 man-hours of study, construction and testing on straight-wing versus sweptwing research and 52,000 man-hours on determining the positioning of jet engines on transports.

• **Glenn L. Martin** climbed to the best financial position achieved over the last six years. "Substantial" deliveries were made to the Navy of the P5M-1 Marlin anti-sub flying boat, and orders have been received for the improved, T-tailed P5M-2. First production P5M-2 is scheduled to come off assembly lines shortly. A modified version of the Marlin is being delivered to the Coast Guard for search and rescue.

The first of a number of RB-57A black-painted, twin-jet reconnaissance planes were completed and put through tests prior to delivery to USAF.

• **United Aircraft's** Pratt & Whitney Aircraft Division produced more power in complete jet engines than in piston types.

Output of J57s is scheduled to increase this year, and production of J48 engines will taper off in 1954. The 5,700-hp. T34 turboprop engine, flown in a Douglas YC-124, this summer will power a military Lockheed Super Constellation

Powerplant availability for the Chance Vought F7U-3 Cutlass, scheduled for Westinghouse J46s, "continues to be a serious problem," UAC notes, but sufficient improvement has been made to permit first Cutlass deliveries to Navy and "to commence reducing the pool of engine-less aircraft already constructed and stored."

The Vought Regulus missile progressed from a research and development project to a production program with flights being made by Navy personnel in fleet training and operational units.

The company says direct foreign shipments this year will be less than in 1953 and, until currently government-restricted P&WA engines and Hamilton Standard products are released for export, it will be unable to compete with foreign industry.

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New Copter Airline Forms in San Diego

A newly organized helicopter airline, known as San Diego Airways, has applied for Civil Aeronautics Board permission to operate copter passenger and mail service over three routes in the San Diego, Calif., area.

The company plans to compete with the San Diego Transit System bus lines for commuter traffic and act as a feeder service for airline passengers. The three planned routes would serve:

- **La Jolla,** Del Mar, Encinitas, Oceanside, Fallbrook, Rancho Sante Fe, Escondido and Vista.
- **Borrego,** Julian, El Cajon and La Mesa.
- **National City,** Chula Vista, San Ysidro, Ocean Beach and Coronado.

Indications are that Lindbergh Field Municipal Airport, one mile from downtown San Diego, will be the copter line's base of operations.

The firm is headed by Charles H. Richards, a San Diego investor. Other officers are local bankers and attorneys.

USAF Commission To Pick Academy Site

A five-member commission to be appointed by the Secretary of the Air Force will select the site for a USAF academy.

If the commission's decision is not unanimous, it will, by majority vote, recommend three sites to the Secretary, who will make the final choice.

Congress has completed action on legislation authorizing the academy, and appointment of the selection commission is expected soon.

▶ **Likely Locations**—Extensive studies have been made over the past few years of possible sites and should facilitate the commission's task.

Seven locations considered most desirable by a former study group: Camp Beale, Calif., near Marysville, an area near Colorado Springs, Colo.; a location near Madison, Ind.; one near Charlotte, N. C.; and sites near Grapevine and Randolph AFB, Tex.

▶ **Fund Difficulties?**—The academy bill passed by an overwhelming majority of 329 to 36 in the House, and by voice vote in the Senate.

USAF's request for academy funds, however, may run into difficulty in the House Appropriations Committee. Rep. John Taber, chairman of the committee, and Rep. Errett Scrivner, chairman of the Subcommittee on the Air Force, both voted against authorizing the academy.

▶ **Temporary Setup**—USAF plans to start with a temporary academy, located at an existing air base near the permanent site. First class of 300 would enter in July 1955, second in July 1956.

By July 1957, it is hoped construction of the permanent academy will be far enough along to transfer these two classes and enter a third.

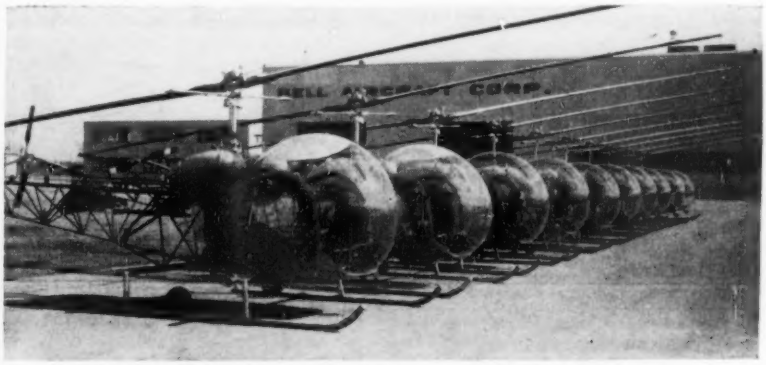
Air Force expects eventually to obtain 600, or 50%, of its annual intake of career officers from the academy.

U.K.'s Pacific Airlines Begin Reorganization

(McGraw-Hill World News)

Melbourne—British airlines in the Pacific are beginning a complete reorganization that will merge some air carriers and realign services operated by the United Kingdom, Australia and New Zealand.

U.K. government pushed the program by insisting on ratification of a reor-



Colombia Gets Copters to Fight Disease

This fleet of 10 Bell 47G copters lined up in front of Bell Aircraft Corp.'s Helicopter Division plant at Ft. Worth, Tex., will be used by the Colombian Ministry of Public Health to combat disease-carrying insects. Copters will spray insecticides over five major malaria areas at an estimated rate of 100 acres per hour. Conventional surface application methods would cost approximately 40% more than using copters.

Facts about *HELI-COIL* inserts in the aircraft industry

What they are

Heli-Coil® screw thread inserts are precision-formed coils of stainless steel or phosphor bronze wire. Wound into tapped holes, they form permanent non-corrosive, strip-proof threads of astonishing strength.

How they cut weight

Threads tapped in aluminum or magnesium when protected by *Heli-Coil* inserts are much stronger, therefore you can use smaller, fewer, shorter cap screws for required strength. Fewer or shorter cap screws mean savings in fastening-weight, through lighter bosses, thinner flanges, and thinner wall sections.

What they are for

AS ORIGINAL COMPONENTS: *Heli-Coil* inserts are used to provide stronger, lighter fastenings, corrosion-proof, wear-proof, threads in all assemblies. Thus you find *Heli-Coil* inserts throughout aircraft engines, airframes, and accessories, from the heart of jet engines to skin inspection panels.

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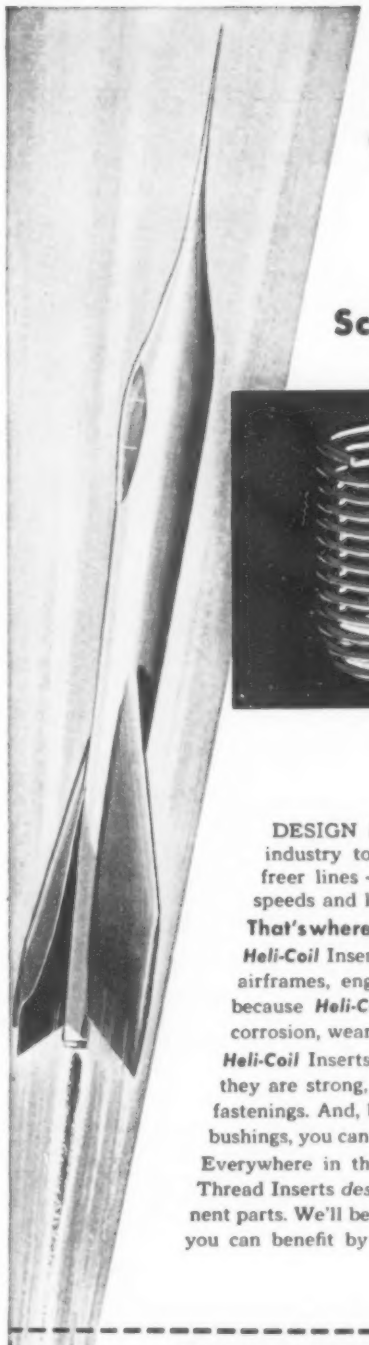

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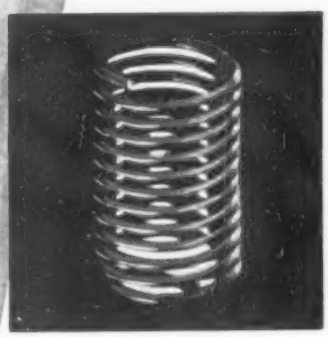

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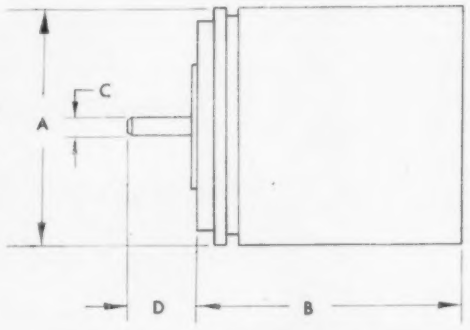

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ganization agreement reached by a civil aviation conference of the three governments last year at Christchurch.

Approval had been delayed by opposition from experts representing all participating sides, who never had agreed to any single plan for building a strong air transport system capable of competing with Pan American World Airways (AVIATION WEEK Feb. 22, p. 21).

▶ **First Step**—Australia is scheduled to purchase British and New Zealand interests in British Commonwealth Pacific Airlines and turn the line over to its government-owned Qantas Empire Airways (AVIATION WEEK Mar. 29, p. 65).

The agreement also calls for Australia and New Zealand to buy out Tasman Empire Airways Ltd., with each of the two countries owning a 50% share.

▶ **Global Network**—Qantas will take over BCPA's trans-Pacific service from Australia to North America, connecting with British Overseas Airways Corp. at San Francisco if BOAC is able to extend its North Atlantic services to that point.

TEAL will connect with the kangaroo route at Sydney and Nandi, Fiji Islands.

"The absorption of the Pacific operation by Qantas Empire Airways will give flexibility and allow greater utilization of aircraft and permit economies through the spread of overheads, the consolidation of spares and, ultimately, the more effective placing of staff," officials say.

▶ **Equipment**—Under the reorganization agreement, QEA will take British Commonwealth's order for de Havilland Comet 2s. Qantas took delivery last month on the first of eight Lockheed Super Constellations and will receive three additional transports at the rate of one a month through June.

Tasman, presently concentrating on flying boat operations, will be re-equipped with BCPA's DC-6s. Some observers say TEAL will have difficulty taking over the DC-6s and predict New Zealand will be forced to begin extensive development of Wellington Airport to enable the four-engine transport to land and take off safely.

PAA Sets Up First U.S.-Orient Teletype

Pan American World Airways began operating a private radio teletype communications network linking main Pacific and Orient points Apr. 1 to coincide with introduction of its trans-Pacific aircoach services.

This marks the first time an airline has established its own leased channels across the Pacific, says PAA. The system will provide 24-hr.-a-day communications from San Francisco to Hawaii, Manila and Tokyo to speed advance bookings, passenger handling and traffic operations.

BERNHARD tries F-84F cockpit for size as Republic president Mundy Peale stands by.

Dutch Prince Favors U. S. Light Fighters

U. S. aircraft designers believe a practical lightweight fighter will weigh approximately 15,000 lb. in contrast to European thinking of 5,000 lb., says Prince Bernhard of the The Netherlands, following a tour of American plane factories and air bases at Pentagon's invitation.

Several light fighter development projects now are underway for Air Force and Navy in the U. S. and others are in the works in Europe, including the Folland Gnat and a Saunders-Roe type.

The prince says he believes the 5,000-lb. goal being pursued abroad is "too light" and leaves out too much essential equipment.

▶ **Coast-to-Coast Tour**—Bernhard's tour started with a visit to Glenn L. Martin Co., Baltimore, and included McDonnel Aircraft Corp., St. Louis; Offut AFB, Neb., where he was a guest of Strategic Air Command chief Gen. Curtis LeMay.

He also toured Douglas Aircraft Co., Santa Monica, Calif.; Lockheed Aircraft Corp., Burbank, Calif.; North American Aviation, Los Angeles; Edwards AFB, Calif.; Biggs AFB, El Paso, Tex.; Eglin AFB, Fla.; Maxwell AFB, Ala.; Airborne Training Center at Ft. Bragg, N. C., and Republic Aviation Corp., Farmingdale, N. Y.

▶ **High Clearance**—Granted high security clearances by Pentagon, Bernhard inspected numerous classified military projects and flew in the North American T-28 and TF-86F, Douglas C-124 and DC-7, Lockheed P2V-5 Neptune, Martin 2-0-2 and P5M-1 Marlin and the Boeing B-47 Stratojet. Although a qualified pilot, including jets, the prince could not fly any single-seater aircraft

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because of a U.S. State Department ruling.

At Republic, Bernhard inspected F-84F production methods and looked at new projects, including the radical delta-wing F-103 and the F-105.

▶ **Defense Drawback**—Other points noted by Prince Bernhard:

• "One of the serious drawbacks in NATO defense is lack of an all-weather fighter." Listing the North American F-86D, Gloster Javelin, de Havilland 110, and the S.O. 4050 Vautour and Dassault Mystere as the current contenders in this field, he says "one will have to be chosen."

• The Dutch have decided to continue training their military pilots in the United States because of the lack of air space in Holland. Some pilot training is done in Canada, but all activities are to be shifted to the U.S. The Dutch are paying the cost of this training.

Chicago's Midway Is Busiest Airport

Chicago's Midway Airport was the nation's busiest airport last year.

Other airports in the top 10 in terms of total traffic as reported by Civil Aeronautics Administration: Miami, Los Angeles, Cleveland, Wichita, Atlanta, New York (La Guardia), Denver, Dallas and Teterboro. Chicago also led in handling air carrier itinerant traffic, as distinct from local traffic. Other leaders in the category: New York (La Guardia), Washington National, Los Angeles, Dallas, Cleveland, Atlanta, St. Louis, Albuquerque, and San Francisco.

There was a 6% increase in aircraft movements during 1953 over 1952. Total 1953 movements were 16,815,133, an average of 1,920 aircraft either landing or taking off every 60 minutes from airports with CAA traffic control towers.

U.S., Airlines Discuss India's Notice on Pact

State Department is continuing talks with representatives of Trans World Airlines and Pan American World Airways to determine a course of action on India's note calling for termination of its air transport agreement with the U. S. (Aviation Week Feb. 1, p. 22).

Concerned over the frequency of service both airlines offer—three flights weekly each—India is demanding that the present bilateral agreement be ended next January. The New Delhi government wants an agreement that would permit its nationalized overseas airline, Air India International, an equal opportunity for U. S.-India business.

▶ **Excess Claimed**—The present agreement was made in November 1946. It included general provisions in regard to the capacity and frequency of air services between the two countries because India had no international airline.

Air India began service two years later. The airline made a survey of the traffic situation and came up with the idea that capacity and frequency of service between India and the U. S. was far in excess of what it believed to be the requirements of traffic.

Informal discussions were held with State Department representatives in New Delhi in November 1951. They ended without solution, which prompted the formal discussions held in India from May to August last year. Each government presented its side but no agreement could be reached.

▶ **Editorial View**—The Indian view point is indicated in a recent article in New Delhi's Hindustan Times, which said:

"During the last six years, a thick network of international air communications has come into being. A stage has now been reached where opportunity should be made available to the under-developed countries to make some progress.

"There are at present 15 foreign airlines operating scheduled air services across India and exercising traffic rights in this country. Between them, they

NEWS Edo NOTES

NEW LOWER COST FLOATS ANNOUNCED

Good news for charter operators and seaplane owners comes from Edo. For aircraft in the Cessna 180 class (2500-2700 pounds gross weight as a landplane), a new float with improved performance and increased buoyancy has been developed and is now on the market.

Known as model 2870 (2870-pound displacement per float), the new floats replace model 2425. They have new, gracefully curving bow section and greatly improved rubber bow bumpers, easily removed. They retain the famed Edo fluted bottom for maximum performance. Rudder control is also greatly improved.

Despite these improvements and increased displacement, the 2870's are priced at $3,995—$1,605 less than last year's price on the 2425's.

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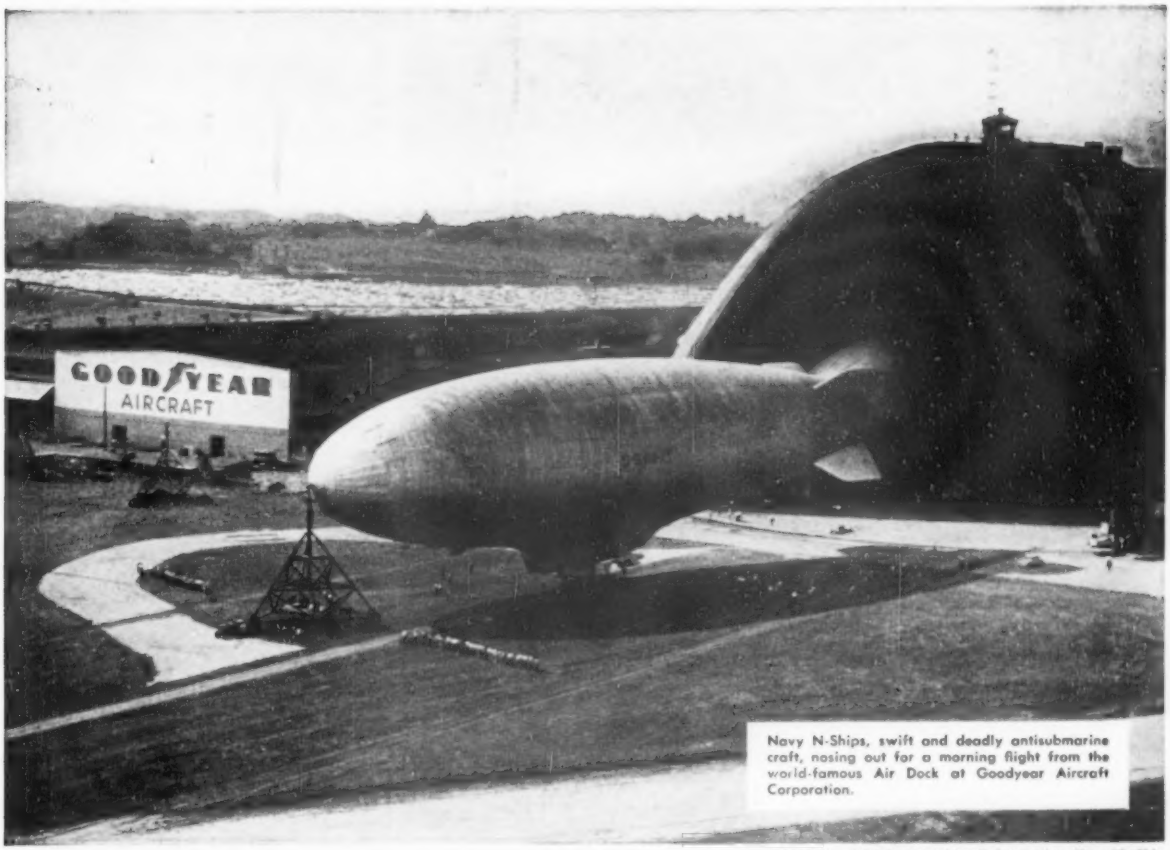

Navy N-Ships, swift and deadly antisubmarine craft, nosing out for a morning flight from the world-famous Air Dock at Goodyear Aircraft Corporation.

Bondolite—T. M. Goodyear Aircraft Corporation, Akron 15, Ohio

SPAWNING GROUND FOR SPECIAL SKILLS

ODDLY enough, all manner of aircraft have benefited greatly from the development of the airship.

The first all-metal-frame Navy bomber owed its structural members built of duralumin at Akron to Goodyear's specialized skills in working pioneer alloys into lighter-than-air craft.

Methods of working, riveting and welding aircraft alloys—first devised by Goodyear's airship group—are now standard practice throughout the aeronautics industry.

Weight-saving BONDOLITE—Goodyear bonded sandwich structural material developed for the deck plates of airships—is now finding many uses in bulkheads, side panels, bomb-bay doors, wing trailing edges and countless other applications where its monocoque construction also offers great strength and insulational qualities.

And a feature of these airships, the giant lightweight radomes—electromagnetically transparent laminates which house the largest sizes of airborne radar—serve a similar function on countless high-speed airplanes.

These special skills, and many more, have made Goodyear Aircraft Corporation a valued teammate to the nation's aircraft manufacturers. As a result, the more than 13,000 men and women of Goodyear Aircraft today are producing for these manufacturers everything from airplane components to complete fuselage shells—including cockpit canopies, radar structures, stainless steel ducting and metal fuel tanks.

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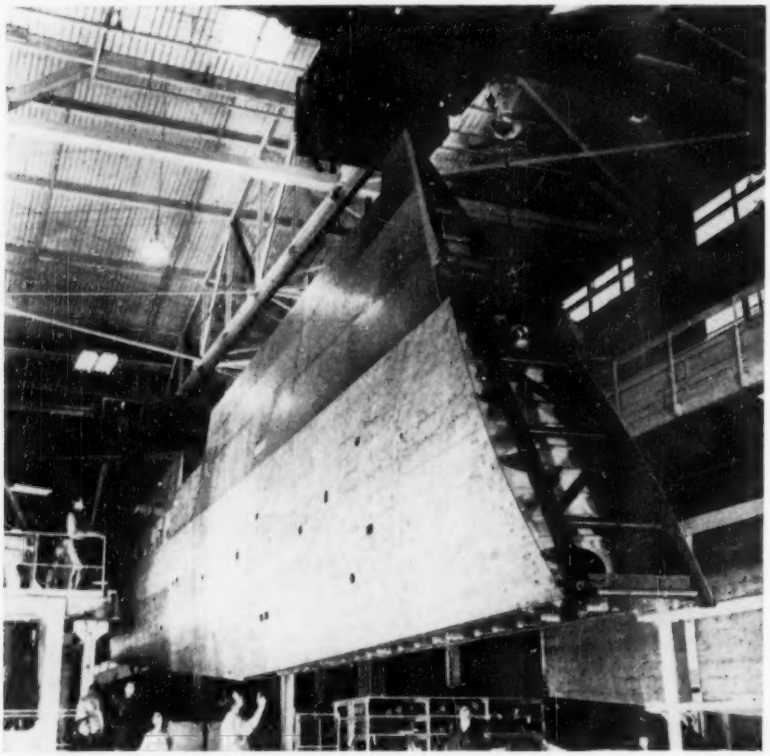
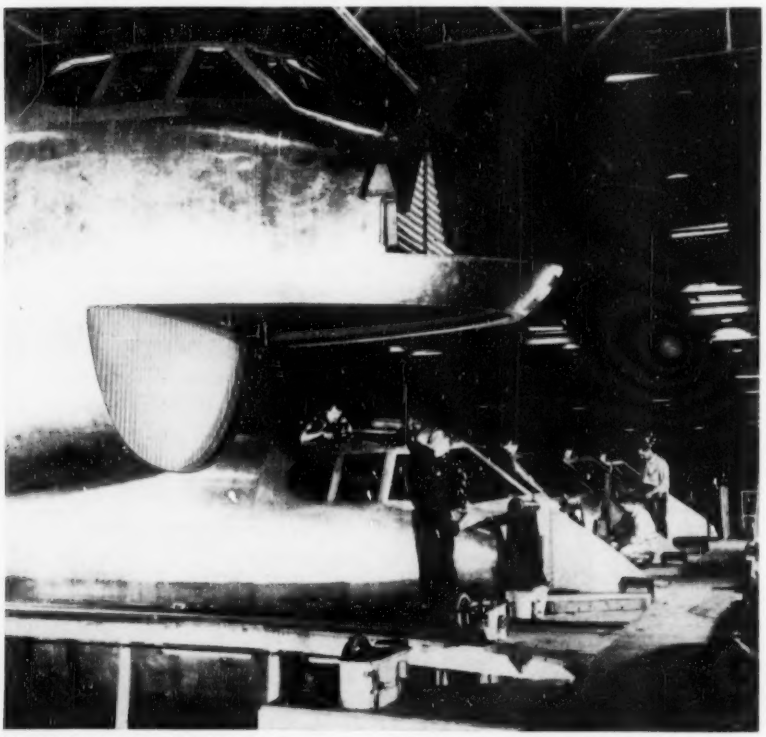
Goodyear Aircraft Corporation, Akron, Ohio • Litchfield Park, Arizona

First Views of B-52A Production



INBOARD WING SECTION for Boeing B-52A, hoisted from assembly jig, reveals huge root end. Opening in center of trailing edge portion will accommodate aileron.



NOSE SECTION of B-52A is lowered into installation jig. Upper and lower compartments faced with aft corrugated bulkheads will house radar, avionic equipment.

are operating as many as 74 services a week or over 10 services a day.

"It is important that there should be some control on the carriage of traffic by foreign airlines. Otherwise the continuance of Indian airlines in their legitimate areas of operation would be gravely jeopardized. It is the earnest desire of the government of India to see that a new agreement is concluded between the two governments which would contain suitable provisions to enable the airlines of the U. S. A. to operate in India in a manner which would not conflict with India's objective."

▶ **Connie, Comet Orders**—Increasing its routes and system, Air India has ordered three additional Super Constellations from Lockheed Aircraft Corp. They are scheduled for delivery early in 1955. Two others ordered earlier are scheduled for delivery in May.

Two Comet 3s are also on order from de Havilland Aircraft Co.

The airline contemplates putting the Super Connies on flights to London and shifting its present Connies to Far Eastern routes.

New routes under consideration are an extension to Tokyo from Calcutta and to Djakarta from Bombay via Colombo and Singapore.

Lightplane Autopilot Passes CAA Tests

An automatic pilot for lightplanes that controls flight on any selected magnetic heading and homes on omnirange stations has successfully completed more than a year of flight tests by Civil Aeronautics Administration (Aviation Week Dec. 29, 1952, p. 11).

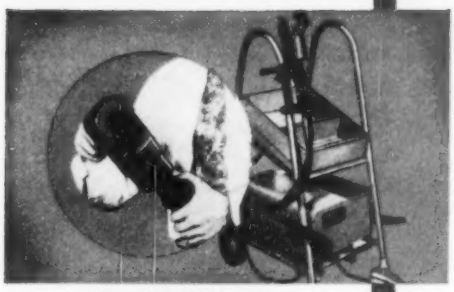
Built by Ansco Division of General Aniline and Film Corp., Binghamton, N. Y., under a $14,888 procurement contract, the new device promises to increase safety and ease of operation of lightplanes. The prototype has been returned to Ansco, which will build production models.

▶ **Maintains Attitude**—The basic unit controls the roll and pitch axis of the aircraft. When the autopilot is engaged, the plane will maintain a heading within plus or minus three degrees and an essentially constant attitude, CAA claims.

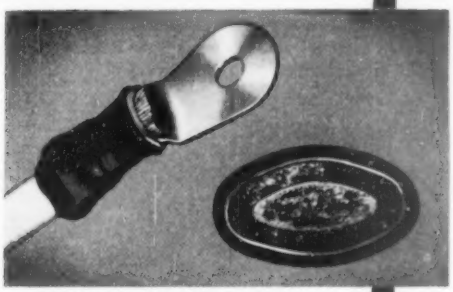
A second part of the equipment is a magnetic compass coupler, designed to maintain the aircraft unattended on a present magnetic heading for a long period.

▶ **Omni-Homing Tests**—CAA's Indianapolis Technical Development and Evaluation Center also tested an omni-homing unit that, when coupled with an omnirange receiver, will fly the aircraft automatically to any CAA omnirange station to which the receiver is tuned.

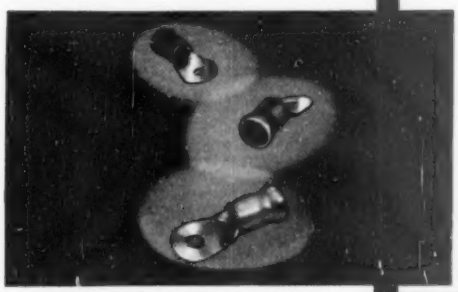
The first and only LARGE SIZE terminal with BONDED INSULATION.



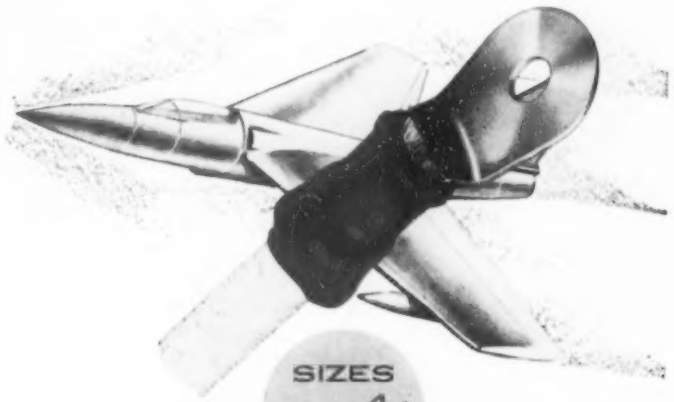
NEW DYNA-CRIMP TOOL
New, powerful, DYNA-CRIMP tool features fast positive crimping action and easily-opened swivel head. Crimping heads can be changed easily. A-MP DYNA-CRIMP tool gives maximum portability with remote control operation. Interchangeable dies are available for use with A-MP's complete line of Aluminum and Flag terminals. Shown above with moveable cart to transport power unit providing maximum flexibility for Bench-Production line use.



BONDING FEATURE MOST IMPORTANT
Bonded insulation is the most important factor *in producing a successful insulated terminal.* The positive and complete bond of the insulation to the terminal sleeve insures uniform insulation thickness under crimping pressures, and therefore transmits this pressure evenly to the center of the crimp area. With this precision-engineered A-MP crimp and BONDED insulation you can be sure of maintaining proper dielectric and tensile values in the finished connection. More intimate contact achieved by confining, over a greater area, terminal and wire under intense crimping pressure.



OTHER IMPORTANT A-MP "FIRSTS"
Completely separate metallic reinforcing ring grips wire insulation, prevents exposure of conductor during sharp bends, cable fatigue caused by flexing and vibration and forms a barrier to foreign objects coming in contact with current carrying members. New helical tongue design gives maximum strength with minimum weight.



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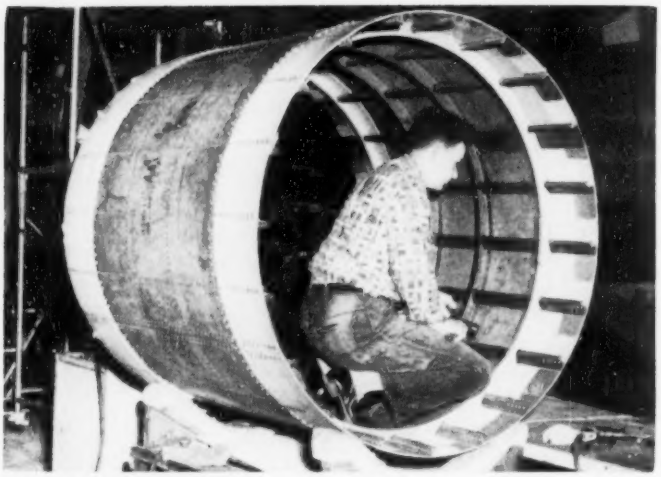
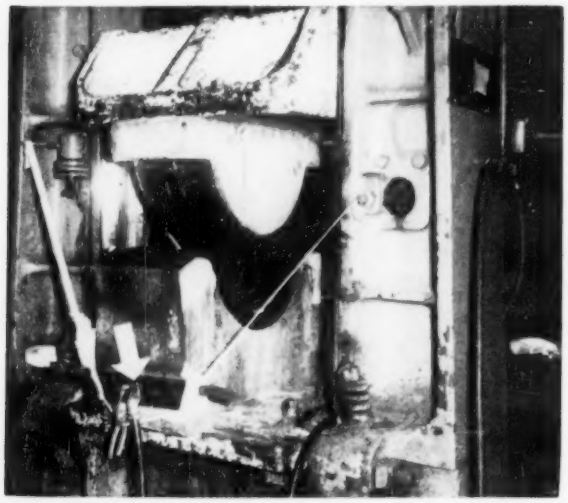


HORSION TEST CYLINDER in Republic Aviation's titanium studies has rolled skin (dark area), hot-formed channel formers and J-stringers.

STRINGER has edge areas flattened hot. Fixture (top) holds part to shape during stress-relieving.



HAMMER is used for forming nose section, shroud segment. Latter, with heating electrode attached (arrow), is seen in die.

SHROUD SEGMENT formed in hammer. Trim material may be shortened by boosting power for resistance heating of part.

Republic Team Digs Up Titanium Data

By Irving Stone

In highspeed military planes of the near future, titanium alloys will figure as importantly as aluminum alloys did in the aero picture for the early thirties.

The reason: Planes can't be built efficiently to fly appreciably faster than they do today unless they utilize titanium alloys or other metal with equivalent or better strength/weight and thermal characteristics.

At the present reading, titanium alloys do not seem to have much competition for top billing.

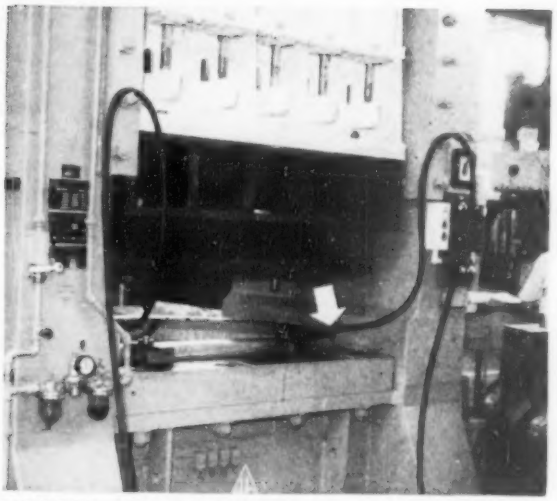
► **Look Ahead**—Already research, design and production groups are doing ground-floor jobs in preparation for large-scale use of the metal. Within five to 10 years it is likely that all high-performance aircraft will have titanium alloys as a major portion of their makeup —perhaps 75% or more.

By that time, today's tight supply problem for the metal should have been resolved, physical capabilities pinpointed, and manufacturing difficulties almost entirely solved, according to engineers at Republic Aviation Corp., Farmingdale, N. Y., who are deep in titanium studies now.

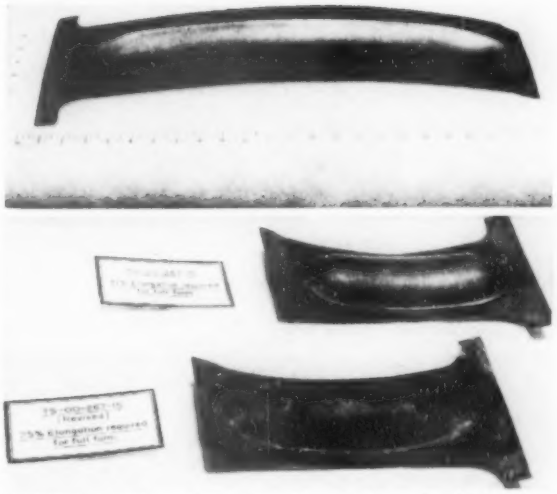
This widespread use of titanium alloys will be with new formulations of the metal, considerably different from those of today, and which surely will be developed, they feel.

► **Need More Data**—Republic engineers are making extensive studies of titanium alloys for application to aircraft structures, because they feel that the current amount of service data on the metals is insufficient to warrant going ahead without basic engineering and manufacturing research of their own.

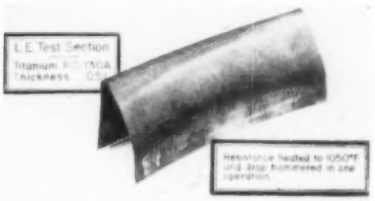
Republic is specifically interested in



CHANNEL SECTION FORMER is made from .040-in.-gage blank in Clearing press. Heating electrode (arrow) attaches to end of blank, which is separated from die by insulators.



DEEP BEADS have been formed as single units shown here and as multiple units in single panel. Single beads with 3:1 width-to-depth ratio are made in rubber-forming process.



LEADING EDGE SECTION is formed hot in drop-hammer in single operation.

SANDWICH FORMING SCHEME for beads has titanium alloy sheet between two faces of .032-in. steel material which provide support and improve heat retention.

learning how the material stands up after fabrication into assemblies and installed for service conditions, as distinguished from its room-temperature performance.

This approach to the problem has brought on an extensive evaluation program at Republic, which has resulted in very close liaison between the firm's Engineering Research and its Manufacturing Research. Prime purpose of this teamwork is to establish both design and manufacturing criteria. It is also a means of obtaining minimum cost projections for future production.

▶ **Research Teamwork**—Engineering Research designs structural parts in titanium alloy, tests all components to simulate service conditions. It also does property evaluations, dealing with raw material and finished product.

Manufacturing Research designs the tools to manufacture the parts, especially where these tools deviate from normal practices. It also defines the method to be applied for parts manufacture. Throughout the manufacturing process, this activity keeps a metallurgical eye on the material and selects the specimens or parts for property evaluation by Engineering Research.

▶ **Working with RC-130A**—First manufacture and evaluation of a titanium part at Republic was back in 1950. This was an engine shroud for the F-84E, manufactured from Rem-Cru Titanium, Inc.'s commercially pure metal.

This was strictly a manufacturing research job and actually it was at this point that Republic's Manufacturing Research activity was born. Following this, ammunition box assemblies were fabricated of RC-70 and then work

Recommendations for Titanium Working

Republic Aviation engineering and manufacturing researchers have come up with a number of general recommendations for handling titanium alloys, as a result of their studies of RC-130A. The recommendations include:

• **Minimum design bend radius** on material of any length generally is 4t for metal up to .064 in., and 5t for .070 in. and up.

• **Extensive care must be observed** in the shop, in the preparation of material, to avoid all notches, scratches, particularly with respect to edges. Edges must be draw-filed lengthwise and sharp corners and wire edges removed, since these are points of stress concentration.

• **Avoid use of metal stamps,** scribers, and acid etches. Marking is being done by grease pencil, rubber stamp or marking pen. (This indicates that identification of parts and material may pose a difficult problem in titanium operations.)

• **All heating operations** must be under strict control for time at temperature and degree of heat applied. Time at temperature should be at a minimum, heat should never exceed about 1,150F.

• **No torch heat should be used.** It is difficult to control, hot spots result.

• **No descaling,** chemical or mechanical, is recommended.

• **Hand work should not be used** to form the material. It is not economical, is too difficult an operation, and too many failures occur when material is so formed.

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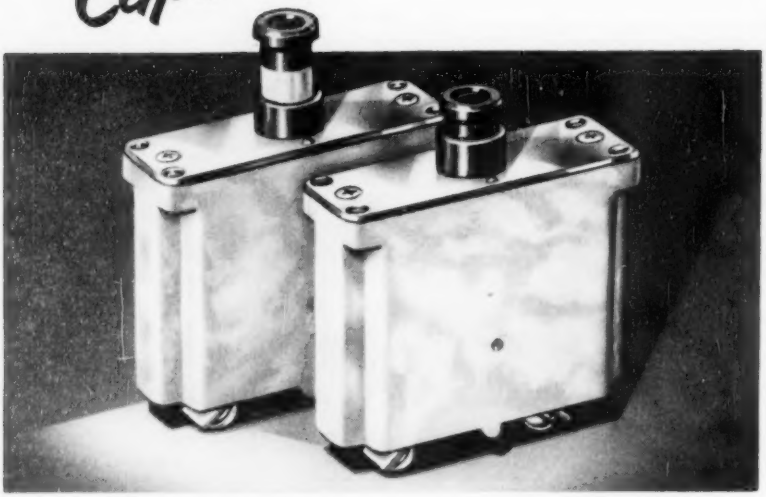

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LONGERON of .102-in. gage is formed hot on 75-ton brake. Cold forming would require job to be done on 200-ton machine.

progressed to include the utilization of alloys.

These included progressively, Rem-Cru's RC-130A sheet, Titanium Metals Corp.'s Ti-150B, then back to RC-130A in its present form, and RC-130B (bar stock). Rem-Cru material was selected because quantities could be obtained, Republic engineers say, adding that they consider the RC-130A material as good a titanium alloy as any available today.

► **Experimental Jobs**—Details of some of Republic's experimental manufacturing with RC-130A follow. They were analyzed for AVIATION WEEK by R. E. Stegler, manufacturing research and development engineer.

Hot-forming generally is being used for RC-130A sheet. This is because of the increased elongation of the material at high temperatures, making forming easier. Hot-forming also minimizes effects of material inconsistencies and makes for a more efficient structure weightwise because of the smaller bend radiuses which can be obtained.

The only cold-forming jobs found to be successful to any degree are in those operations requiring only straightline bending on generous bend radiuses (4t-plus), or forming contours, etc., by cold rolling or limited stretch forming.

The first experimental assembly completed at Republic—about three months ago—is a torsion test cylinder 52 in. in diameter. This RC-130A structure is composed of skin, stringers and formers.

► **Cylinder Forming**—The skins (.032 in.) were rolled cold to contour in the conventional manner. Main problem was greatly increased springback. This difficulty required tighter roll settings and more power.

Stringers (.072 in.) were hot-formed to a J-section configuration on a power brake. The material was heated over a gas burner mounted immediately in front of the brake. This experimental heating setup might be replaced for a production run with an electrically heated platen which would bring the piece to about 900-1,000F, after which it would immediately be transferred to the brake and formed.

Formers (.040-in.-gage channel sections) were hot formed in a simple male-female die on a Clearing press. The metal blanks were brought to

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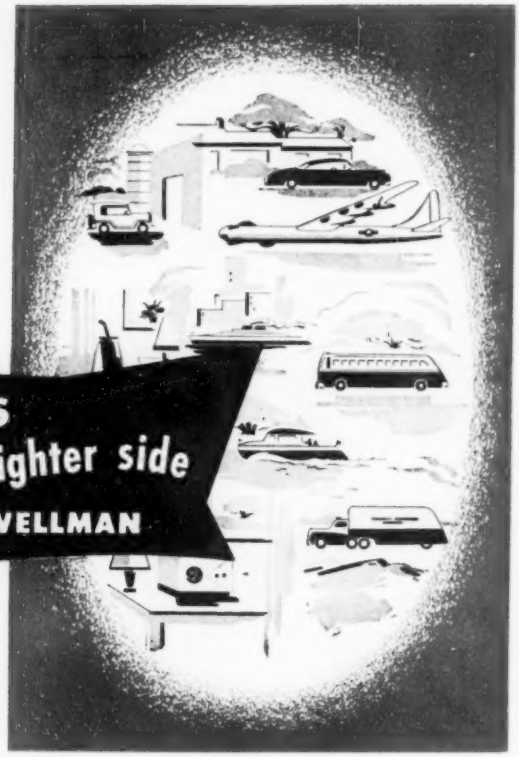

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1,000-1,100F by resistance heating (350 amp., low voltage) with electrodes attached to the excess material at the ends of the blanks in the press. Heating cycle was about 20 seconds. Transite insulators were positioned between the blank and the die.

▶ **Production Aspects**—This experimental forming setup could be used efficiently as a production procedure with slight modification for control and more speed in parts loading and removal. Because electricity is fed directly to the part being formed, some degree of operator reorientation might be required, Stegler notes.

Assembly methods used for the torsion cylinder were conventional except that a special drill-bit design was developed to permit greater ease in the drilling operation and insure roundness of holes. Rivets used are standard stainless steel units.

Evaluation tests of the torsion cylinder currently are in progress.

▶ **Deep Beads**—Another experimental study is concerned with deep-drawn beads. In view of increased stiffness requirements seen for future aircraft, forming of beads with a width-to-depth ratio of 2.6 to 1 has been attempted for multiple beads in a single panel. However, indications are that ratios better than 4 to 1 will not be possible. (Ratio considered standard for multiple beads in other materials is between 5 and 6 to 1.)

Single beads (.032 gage) with a width-to-depth ratio of 3 to 1 are being made in a rubber-forming process utilizing a female form block on a hydraulic press. A special high-temperature-resistant rubber (Hy-Drop, made by Rubbercraft Corp., Torrance, Calif.) is used in the rubber holder mounted on the ram of the press. This rubber material withstands the temperature of the hot sheet metal during the forming process, Stegler says.

▶ **Sandwich Forming**—Hot-forming of the bead takes place at about 1,000-1,100F with one operation at 4,000 psi. The RC-130A sheet is sandwiched between two sheets of SAE 1010 or 1020 steel (about .032 gage), all three pieces are brought up to heat in an electric furnace, then transferred to the press and formed as a unit.

The steel envelope affords these advantages:

• **Better heat retention** is attained in the titanium alloy sheet during transfer from furnace to press.

• **Support is provided** during the forming. This, it is believed, tends to reduce necking (thinning, usually accompanied by rupture) so prevalent at the forming temperature.

Numerous satisfactory parts have been obtained with this steel sandwich procedure.

The single beads formed are assem-

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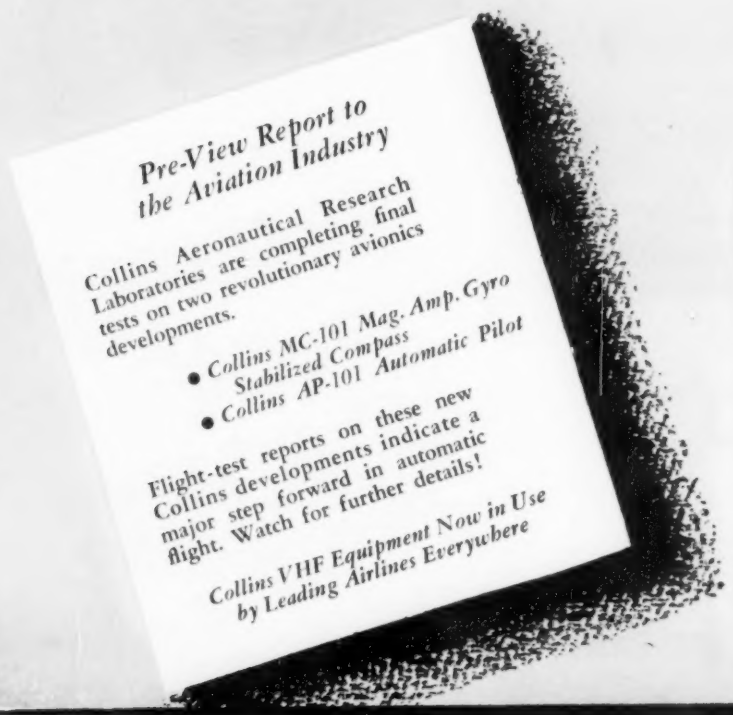
If you fly an airplane with limited rack space, be sure to investigate Collins new 1/2 size 17L-4 VHF transmitter. Available soon from your nearest Collins office.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Flight-test reports on these new Collins developments indicate a major step forward in automatic flight. Watch for further details!
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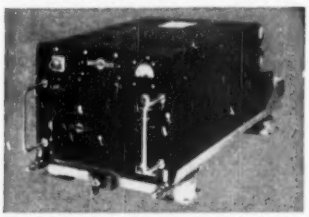
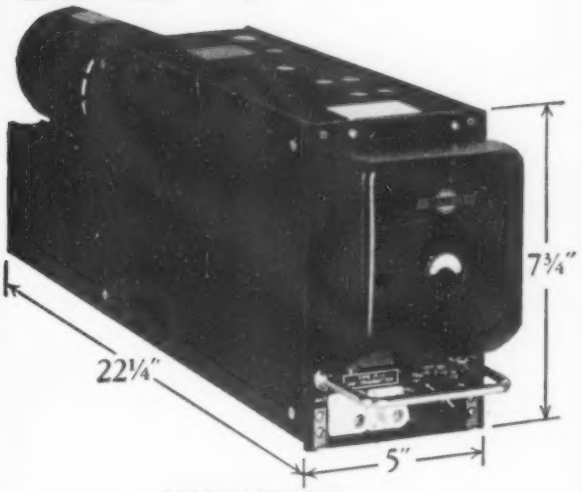
17M-1 360 Channel Transmitter



17M-1 360 Channel Transmitter **is the airborne VHF transmitter designed by Collins to ARINC 520 specification. Collins modular construction in a single ATR case provides ease of maintenance, 360 channels, 50 kc spacing and a minimum of 40 watts power output. This transmitter was specified, designed and built for VHF air-to-ground communications under the most exacting airline conditions and features superior frequency stability which with its high power output and high level modulation guarantees your signal into the busiest terminals.**

transmitter in ½ ATR size!

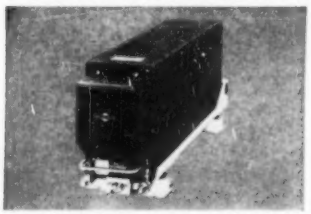
NEW 17L-4



SPECIFICATIONS

Frequency Range	118.00 to 135.95 mc
Nominal Power Output	25 watts
Power Source	27.5 volts DC with negative lead grounded
Case Dimensions	22¼" long, 5" wide, 7¾" high
Weight	25 lbs.
Temperature Range	−40°C to +55°C
Altitude	Pressure equivalent to 35,000 feet
Audio Input	100 ohm carbon microphone; 0.25 v rms input at 1000 cps
Front Panel Controls	Sidetone level adjustment and antenna trimmer
Frequency Stability	The carrier frequency does not deviate from the assigned channel frequency by more than 0.005% under service conditions
Audio Frequency Distortion	Less than 10% at 90% modulation

51X 360 Channel Receiver



51X 360 Channel Receiver one-half ATR size airborne companion to the 17M-1 or the 17L-4 360 channel transmitters. The 51X is not an alteration of existing equipment but is an entirely new design providing for ease of maintenance and through use of new type crystal saving circuits, allows multiple use of crystals. ARINC tubes are used throughout. 3 microvolt sensitivity is provided and 50 kc spacing guarantees complete VHF coverage for present and anticipated needs with 360 available frequencies.

Contact the Collins office nearest you or write for complete descriptive literature.

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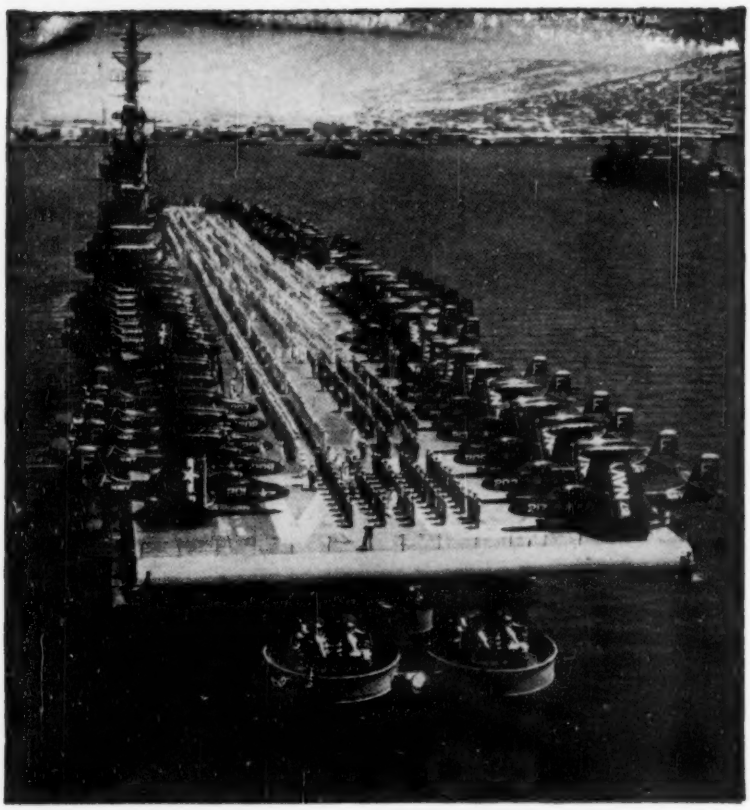
McDONNELL F2H BANSHEES—*Outstanding Navy Fighters*

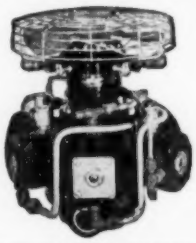


CORNELIUS PNEUMATIC SYSTEMS

Contribute to the Outstanding Success of

McDONNELL FIGHTERS

McDONNELL has been using Cornelius Air Compressors on all production airplanes since 1948. Constant use, month after month, demonstrates the reliability of Cornelius products. Since 1942 Cornelius has built thousands of high pressure air compressors for the leading aircraft manufacturers, Navy and Air Force. Profit from this experience—write to us about your pneumatic equipment requirements.



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4CFM . . . 3000 PSI
Powered by integral hydraulic motor. Other models available with various pumping capacities. All compressors can be furnished with either hydraulic motors, DC electric motors or AC 400 cycle motors.

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AIRCRAFT PNEUMATIC SYSTEMS

bled with a single sheet to produce a multiple-beaded stiffener panel.

▶ **Hammer Jobs**—Some experimental drop hammer operations with RC-130A concern a contoured nose section and a shroud segment. Both these parts were made in a conventional drop-hammer setup using a Kirksite male and a lead female. These dies were not special units, would serve for stainless steel as well. Conventional machine oil, used on the lead die, eliminated heat galling.

Rough-preformed to die shape, the material was heated in place to 950-1,050F by the electrical resistance method, using a standard d.c. motor-generator welding set (600 amp., low voltage). Amount of trim material at the end of the part, where the electrodes attach, can be reduced to 2 to 4 in. by use of an adequate power supply (1,000 amp. or more), Stegler reveals.

Fibrous glass cloth was used for insulation between the material and the die.

Temperature control was by Tempil-Sticks (temperature indicators).

In a production setup, the electrical resistance method for sheet heating would be used wherever applicable, Stegler says. The glass cloth would be replaced by an insert between the sheet and the die.

After a single blow, the hammer is maintained in the closed position for about ½ to 1 min. to insure uniform cooling, thus preventing distortion of the part.

Big advantage of this hot-forming procedure using the hammer is that the material is formed with minimum springback, particularly in intricate shapes. The hammer could not be used with cold material.

▶ **Stringer Operation**—A stringer in the experimental program was subjected to both hot and cold forming. The part—a hat section—initially was brake-formed cold with a bend radius of about 3.5t It was stress-relieved at 1,100F for 18 min., then locally flattened hot at the edges in a power brake similar to that used to form the J-section stringers of the torsion cylinder previously mentioned.

Hot-forming temperature was 850-900F. The stringer was heated uniformly over a gas burner. First one side was flattened, then the piece re-heated and the other side flattened. Very careful operator technique was required to avoid undue warpage resulting from the flattening operation. Springback, approximately 3 to 5 deg., was removed by stress-relieving in a fixture.

▶ **Stress-Relieving Factors**—Except for skin, all formed parts are being stress-relieved at about 1,000-1,100F for 20 min.

Usually, it is mandatory to hold a part to the desired configuration to

HYATT knows the *inside story* on jet engines!

Since 1944, Hyatt has learned a lot about jet engines—and become a major supplier of jet engine bearings. But engine builders have learned a lot about Hyatt, too. They've discovered that Hyatt has the experience, research facilities, and production equipment to build bearings that will withstand the higher speeds and higher temperatures of jet operation. And they've learned that Hyatt quality is something to depend upon. In fact, precision in mass production is a Hyatt trademark throughout the aircraft industry. When design requirements are beyond the capabilities of ordinary bearings, always call on Hyatt.

HYATT

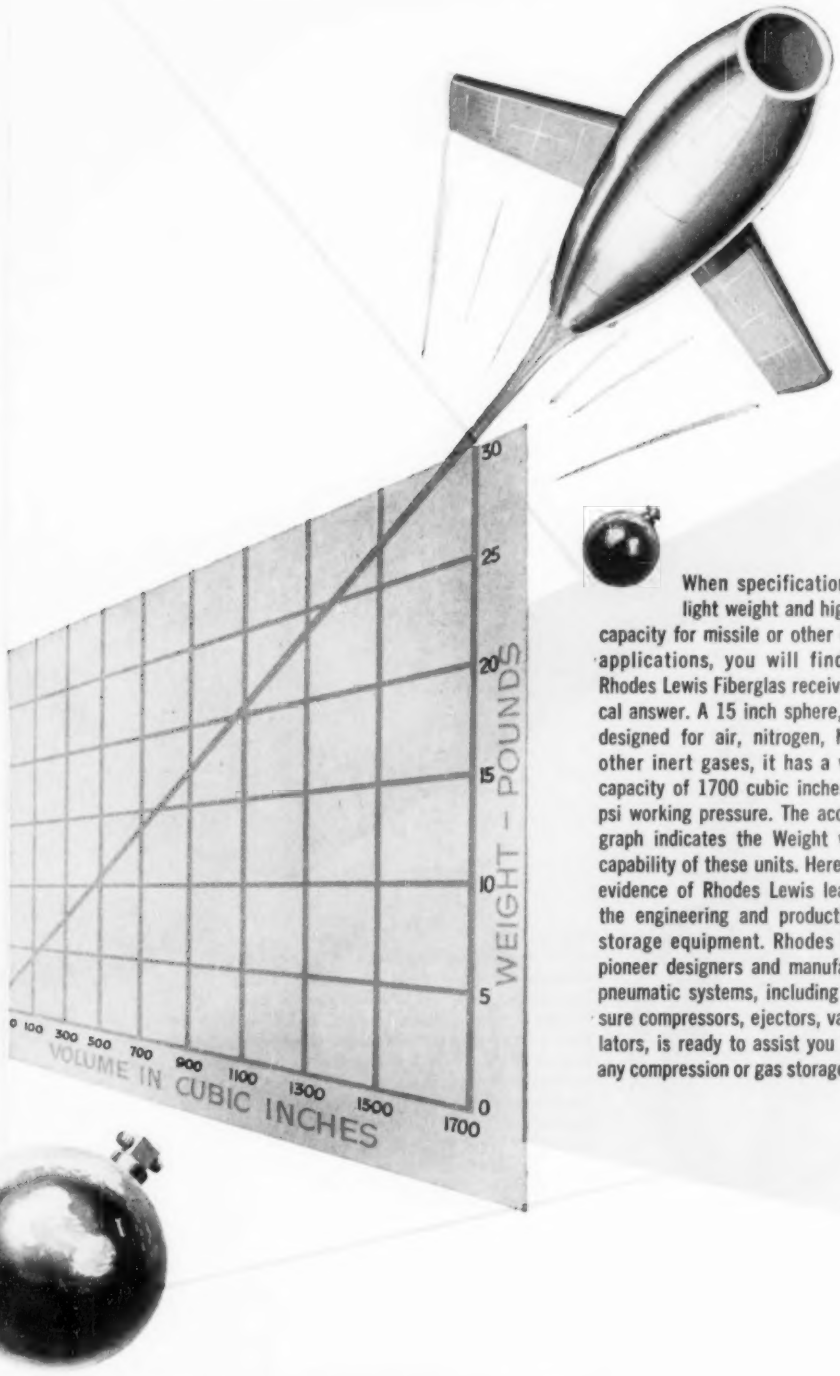
STRAIGHT ROLLER BARREL ROLLER TAPER ROLLER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, NEW JERSEY

Here are just a few of the aircraft using Hyatt-equipped turbo-prop or turbo-jet engines:

Bell X-5 Research Monoplane
Boeing XB-47C Air Force Medium Bomber
Consolidated—Vultee Model 7002 (XF-92A)
Consolidated—Vultee Turboliner
Douglas XA2D-1 "Skyshark" Navy Attack Bomber
Grumman F9F "Panther" Navy Fighter Plane
Lockheed F-80C "Shooting Star" Fighter Plane
Lockheed F-94A & B Air Force Fighter Plane
Martin P4M-1 Long Range Navy Patrol Bomber
Martin B-57A U.S. Air Force Version of the English Electric Canberra Medium Bomber
North American AJ-1 "Savage" Navy Carrier Attack and Search Airplane
Northrop F-89A All Weather Fighter Plane
Northrop YRB-49A "Flying Wing" Heavy Bomber
Republic F84F "Thunderjet" Fighter Plane

WEIGHT COUNTS



When specifications call for light weight and high pressure capacity for missile or other expendable applications, you will find the new Rhodes Lewis Fiberglas receiver the logical answer. A 15 inch sphere, especially designed for air, nitrogen, helium and other inert gases, it has a volumetric capacity of 1700 cubic inches for 3000 psi working pressure. The accompanying graph indicates the Weight vs. Volume capability of these units. Here is striking evidence of Rhodes Lewis leadership in the engineering and production of gas storage equipment. Rhodes Lewis Co., pioneer designers and manufacturers of pneumatic systems, including high pressure compressors, ejectors, valves, regulators, is ready to assist you in meeting any compression or gas storage problems.

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avoid warpage. For this purpose, stress-relieving fixtures are used. These fixtures serve as a partial forming means in that springback errors, etc., may be corrected. This correction cannot be done with hand work as normally done with other metals.

▶ **Descaling Data**—Currently, no descaling is being done at Republic on any of the formed parts. Initial attempts, using an aqueous solution of 2% hydrofluoric and 3% hydrochloric acids, resulted in certain instances in promoting stress corrosion cracking in sheared edges, Stegler says, while mechanical descaling—shot peening, sandblasting—creates notches affecting fatigue life.

Until there is a practical need for the process, Republic does not intend to descale the alloy, Stegler claims. Meanwhile, descaling procedures are being investigated to determine the effect on material properties.

▶ **Engineering Research**—Along with its manufacturing research on titanium alloys, Republic is doing extensive engineering research. Projects in this section's materials and processes group (headed by D. G. Reid, formerly with Chance Vought Aircraft) were outlined for AVIATION WEEK by Edward A. Simkovich, senior research engineer.

The materials and processes group supplies data to engineering development. A long program is under way on RC-130A to determine material properties and applications. Work is aimed at generating information not available from any other source, Simkovich says.

Factors being investigated include the following:

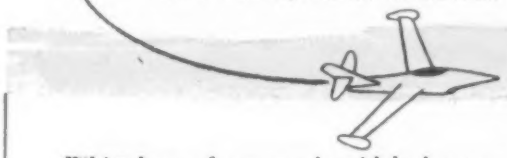
- **Room- and elevated-temperature** tensile and compression data for a large variety of mill heats, sheets and thicknesses.
- **Creep characteristics** at elevated temperatures, and fatigue data for notched and unnotched material at both room and elevated temperatures. Work on creep and fatigue at high temperature will be done at Wright Air Development Center because it has the equipment to perform these analyses.
- **Crippling allowables** for formed sections.
- **Joint allowables** at elevated temperatures.
- **Thermal properties**—coefficient of thermal expansion, conductivity and electrical characteristics.
- **Effect of repeated heating** on room- and elevated-temperature characteristics.
- **Low-temperature properties.** Characteristics will be investigated at temperatures down to −65F.
- **Hardware** will be investigated in static and fatigue tests. Units will include RC-130B bolts, screws, nuts, and rivets. Detailed parts formed by Manufactur-

(Advertisement)

Valve Talk

for WM. R. WHITTAKER CO., Ltd.

by Marvin Miles,
Senior Member, Aviation Writers Assn.



Whittaker, of course, is widely known as an aircraft valve concern, but not until I probed behind the phrase "motor operated" did I learn that the Southern California company is also one of the industry's largest manufacturers of fractional horsepower electric motors.

In fact 6 out of every 10 Whittaker valves are motor operated and they now turn out about 8000 of these power units a month on two production lines that can double this total if need be.

Why does Whittaker produce its own motors and actuators?

The reasons are simple – and basic: Superior designs . . . perfect mating with valves . . . tighter quality control . . . faster production at reduced cost . . . constant supervision . . . application flexibility . . . pacing in design and development . . . elimination of divided responsibility . . .

Engineers use the phrase "made for each other" in speaking of the value in producing motor-actuator and valve in close coordination of design and manufacture.

"If your motors are built by outside electrical houses," they explain, "it goes without saying that the combination of valve and actuator cannot be as perfect as when you produce them both yourself. Motor deficiencies that handicap valve operation are bound to show up.

"Sure, the reverse is true, too, when valve deficiencies handicap motor performance. But when you build both units in one plant you're right on top of the problem because it's your own responsibility. Time-wasting liaison is eliminated, red-tape is non-existent and there's no rat race.

"Besides, when you're dealing with sub-contractors, you're not only competing with other companies for production and denying yourself the advantages of your own personal interest and engineering skills, you're also giving up flexibility which, in Whittaker's case, can quickly and easily transfer motors and actuators from one order to another to meet any emergency."

When I say Whittaker builds its own motors, I mean just that — from the bare copper wire on up. All the necessary tooling, including winders, test and run-in panels, was designed and produced in the plant which houses its two assembly lines in different buildings and its motor-actuator engineering offices in a separate area.

Credit for the success of this most important division of Whittaker production goes largely to Don McLennan, executive vice-president, from whose hieroglyphics and "doodle sheets" have come a variety of designs and motor windings that have marked up continuing achievements for the company.

McLennan's basic motor – a permanent magnet type – made Whittaker one of the first successful producers of motor operated valves and proved so efficient it is still in heavy production, along with new and improved types for gate valves, butterflys, rotary selectors, plug types, etc.

The Douglas A-26 (now B-26) was the first ship for which Whittaker produced motor operated valves – the first that tested the company's skill in providing electric power for remote operation (for engine oil flapper units) and the forerunner of every new military airplane and commercial transport that requires tiny motors to actuate cycling in the deep recesses of wings and fuselage.

Not only must these little motors function with precise precision, their power must be transmitted to the various valves through perfectly designed actuator gear trains of from two to six "passes" in spur or planetary gears.

Whittaker to date has developed five general types of motors — with continual improvements, of course, to meet pressure differences and varying requirements in operating times. And as complete motor-actuators, more than 180 variations have been designed, with 45 different varieties currently going through the two assembly lines.

Each motor is tested numerous times before it is installed, including a tachometer test to determine its exact operating speed, usually from 14,000 to 16,000 r.p.m. Gear trains, too, receive check after check to assure efficiency. So despite their delicate composition, the motors invariably last the life of the valve.

This is not to say there are no problems in motors and actuators. There are plenty of them, in weight reduction vs. performance, in temperature ranges that affect operation, in sealing methods, in meeting the many special requirements such as light indication, fail-safe devices, etc.

But why should you think about such problems? That's Whittaker's business!

DEFENSE PRODUCTS *of High Quality at Low Cost* **DELIVERED ON TIME**

Classrooms for the training of field service personnel are equipped with the most modern facilities.

Field Service Training *That Pays Off*

One of the most vital factors in maintaining complex electro-mechanical devices – as well as test equipment – at maximum efficiency in the field is the caliber of the civilian and military personnel responsible for their day-to-day upkeep and repair.

To adequately train both civilian and military personnel, AC maintains completely equipped and staffed schools, and supplies the Armed Forces with civilian technical personnel – under contract – for assignment here and abroad.

AC is now producing – in volume – these complex, high-precision, electro-mechanical devices for the Armed Forces:

- **"A" Series Gun-Bomb-Rocket Sights**
- **A-1A Bombing Navigational Computers**
- **T-38 Fire Control System for the Skysweeper**

AC SPARK PLUG DIVISION . . . GENERAL MOTORS CORPORATION . . . FLINT, MICHIGAN

AC KNOW HOW

If you want to know more about AC's defense production activities and facilities, write for brochure "Producing For Defense."

ing Research will be checked to see if they conform to Engineering Research's minimum allowables.

These are but a few of the items in Republic's titanium alloy studies. The learning curve for the metal has been relatively steep, but the total amount of time spent on the material, as compared to other materials, has been small. This fact, plus the relative newness of the product, is making the overall evaluation a comparatively difficult problem, Simkovich and Stegler say.

PRODUCTION BRIEFING

▶ **Northrop Aircraft, Inc.,** Hawthorne, Calif., has begun using its new 250,000-sq. ft. facility at Palmdale, Calif., on a limited basis. Buildings were scheduled to be completed early in February. Full operation of Northrop-Palmdale will await completion of runways and other joint flight facilities in mid-1954.

▶ **Thompson Products, Inc.,** Cleveland, Ohio, will spend $16 million this year for expansion and modernization. A research building is to be built at the firm's Tapco plant in suburban Euclid, a new plant is planned for the company's St. Louis subsidiary, Ramsey Corp., and another one in the Detroit area. Also several million dollars are to be spent on new machine tools, automation projects and other improvements.

▶ **Panellit, Inc.,** maker of automatic control and information systems, has started construction of a new plant at 7401 Hamlin, Skokie, Ill., to provide 82,000 sq. ft. of floor space with permissible expansion to 150,000 sq. ft.

▶ **Permatex Co.,** Brooklyn, N. Y., maker of sealing compounds and maintenance chemicals, will build a $500,000 plant in Kansas City, Kan., and plans to have the new facility in operation by August.

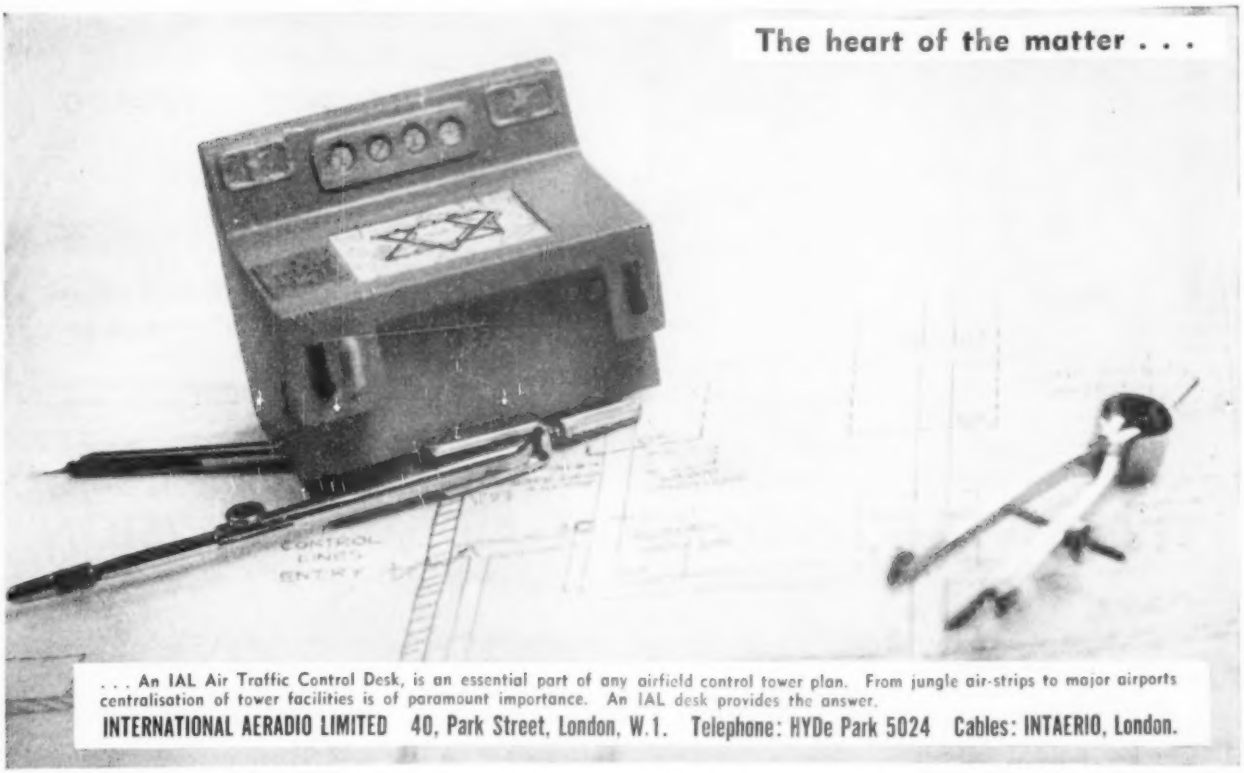
▶ **Standco Canada, Ltd.,** Toronto, Ont., has been formed by Standard Pressed Steel Co. as a wholly owned subsidiary to supply Ontario and Quebec provinces with precision metal fasteners.

▶ **Morey Machinery Co., Inc.,** has moved its executive offices to 583 Lafayette St., at East Fourth Ave., New York 3, N. Y. The firm expects to occupy the ground floor of the building by the end of the year, with a showroom for machine tools, and expects to add new lines of foreign and domestic tools at that time.

Air Gage Speeds Bucket Inspection

Use of an air inspection gage for turbine buckets will save $13,500 annually at General Electric's accessory turbine manufacturing plant, Lynn, Mass., the company estimates.

Checking 13 machining dimensions and completing final inspection in one positioning of the bucket, the gage is


The heart of the matter . . .
. . . An IAL Air Traffic Control Desk, is an essential part of any airfield control tower plan. From jungle air-strips to major airports centralisation of tower facilities is of paramount importance. An IAL desk provides the answer.
INTERNATIONAL AERADIO LIMITED 40, Park Street, London, W.1. Telephone: HYDe Park 5024 Cables: INTAERIO, London.

a refinement of a Sheffield Precisionaire contour checker.

For the inspection operation, the turbine bucket is positioned in the instrument's jaw, clamped by a foot-operated air cylinder, then advanced to the gaging position on a ball slide. The inspector then scans 13 air columns for the dimensional check, the bucket is retracted, unclamped and removed.

GE says that formerly six individual gages were required to do the job.

BuAer Contracts

The following contract awards of $25,000 and more have been announced recently by the Bureau of Aeronautics, Department of the Navy, Washington 25, D. C.

CURTIS LABORATORIES, INC., Los Angeles, Calif., research for the development of 7- and 10-inch periscopes to adapt the CR-1A radar recording camera to 7- and 10-inch radar indicators, including the furnishing of one prototype of each type of periscope so developed, 10-inch periscopes for evaluation, 25 ea., 7-inch periscopes for evaluation, 50 ea., $118,750.

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif., kits of parts to incorporate Master Change 1027 (automatic approach system), DS-1192, in Model R4D-8/82 aircraft, 10 ea., $84,999.

GENERAL ELECTRIC CO., Schenectady, N. Y., power units, portable, 28-volt, d.c., 500-amp. output, spare parts, dwgs., 38 ea., $65,772.

GILLILAND INSTRUMENT CO., Oakland, Calif., armament control director, Aero 7A, drawings, 156 ea., $64,087.

JACK & HEINTZ, INC., Cleveland, Ohio, starters, model E-1, spare parts, publs., dwg., 361 ea., $173,536.

MOLDED INSTALLATION CO., Philadelphia, Pa., radiosondes, AN/AMT -7 (B), complete with (1) temperature evaluator and (1) instruction book per (8) radiosondes, 12,000 ea., $245,000.

UDYLITE CORP., Long Island City, N. Y., dismantle and move the existing plating and surface pre-treatment shop from its present location at NAS, Norfolk, Va., to a new location at said station; rearrange and re-erect the existing equipment, replacing any damaged sections or parts; furnish and install necessary new equipt. and furnish utility services, all as may be required to place the relocated shop in complete operation, $378,896.

UNITED AIRCRAFT CORP., (Sikorsky Aircraft Div.), Bridgeport, Conn., materials and service necessary to perform final demonstrations of Model HRS-3 helicopter as a result of the change from an R1340-57 to an R1300-3 engine, and also structural and other changes which resulted from said change, job, $33,691.

USAF Contracts

Following is a list of recent USAF contracts announced by Air Materiel Command.

Aircraft Products Co., Church Road, King Manor, Bridgeport, Pa., power system, 42 ea., spares, $135,608.

Chas. Beseler Co., 60 Badger Ave., Newark 8, N. J., projector, opaque, 200 ea., 100 ea., $67,044.

Collins Radio Co., Cedar Rapids, Iowa, transceiver, spare parts, $1,892,202.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., transmitter, 3,217 ea., 2,384 ea., 1,657 ea., $3,087,945.

Goodyear Tire & Rubber Co., Inc., 1144 E. Market St., Akron 16, Ohio, wheel assy., 140 ea., brake, 140 ea., $87,859.

Curtiss-Wright Corp., Propeller Division, Caldwell, N. J., modification of C735S-B4 propellers, $33,524.

Federal Aircraft Works, Minneapolis, skis, 17 ea., $33,490.

Aerojet General Corp., 6352 Irwindale Road, Azusa, Calif., Rato boosters, Model 2.5KS-18000, 12 ea., $61,872.

Bill Jack Scientific Instru. Co., Solana Beach, Calif., training requirements for universal camera, control system, $141,543.

Consolidated Vultee Aircraft Corp., Govt. Acft. Plant #4 P.O. Box 371, San Antonio Air Materiel Area, Fort Worth, Tex., provide funds for B-36 and RB-36 aircraft, $88,039.

General Electric Co., 1 River Road, Schenectady 5, N. Y., generators, 101 ea., regulators, 101 ea., controls, 101 ea., $280,169.

Republic Aviation Corp., Farmingdale, L. I., N. Y., interim billing price, F-84F airplanes, $29,766,984.

Wright Aero. Div., Curtiss-Wright Corp., Wood-Ridge, N. J., facilities, production of YJ67 engines, $1,846,000.

Dayton Rubber Co., Dayton 1, Ohio, oxygen mask tubes, $35,847.

Flight Research, Inc., P.O. Box 1-F, Richmond 1, Va., camera, spare pts., 15 ea., data, 30 ea., $51,300.

Hobart Bros., Troy, Ohio, generator sets, 873 ea., spare pts., $3,381,998.

Lockheed Aircraft Corp., P.O. Box 551, Burbank, Calif., F-94C aircraft, 279 ea., $25,828,425.

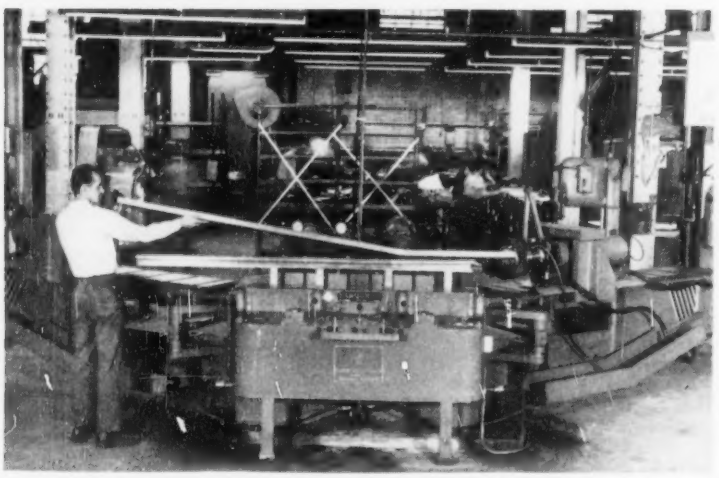
Marathon Elec. Mfg. Corp., Wausau, Wis., ground elec. support sys., 76 ea., spare parts, $8,936,528.

Northrop Aircraft Inc., Hawthorne, Calif., training parts, tools and equipment, $500,000.

U. S. Gauge Div., American Machine & Metals, Inc., Sellersville, Pa., indicator, multi-purpose, 937 ea., $41,827.

Pacific Optical Corp., 5965 W. 98th St., Los Angeles 45, Calif., lens assy., 505 ea., $29,290.

OLIVER AVIATION *extends their service to you*



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One of the many aircraft components now in production is the principle fuselage section of the RB-47E jet airplane.

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*Complete brochure on plant facilities available upon request

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At a signal, aluminum — heated to an exact thermal degree—begins to flow through hardened steel dies. Trained eyes follow the wide, ribbed shape as it emerges to 30 feet . . . then 60 . . . then 90 . . . or 110 feet if necessary. The 14,000-ton "muscles" relax . . . another quality Alcoa extruded shape.

This extruded shape is one of the largest in the world . . . but the difference between it and others is much more than size alone. The men who handle the die design, the die construction, the preheating, the extrusion pressure . . . are all members of an Alcoa team. This team was selected by the Air Force to operate this and other presses in the "heavy press program"—the team with unmatched skill and 50 years' experience in the extruding process.

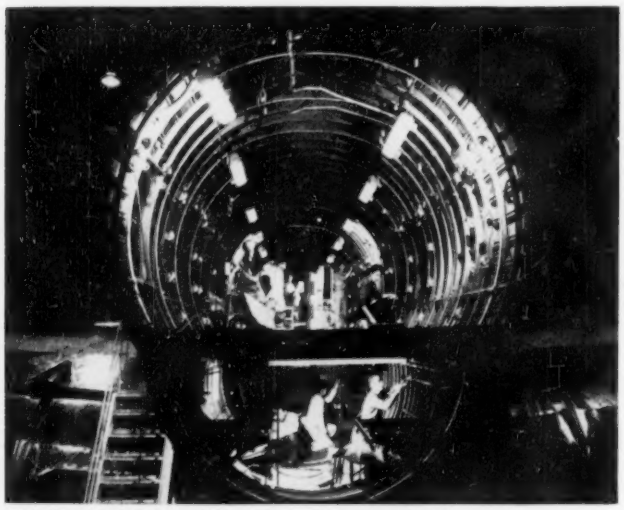
Larger extruded shapes, thinner and more intricate than ever before, are rapidly becoming the answer to rising costs of riveting and assembly. Your nearby Alcoa sales office is your short cut to 66 years of experience with aluminum. ALUMINUM COMPANY OF AMERICA, 1800-D Alcoa Building, Pittsburgh 19, Pa.

ALCOA ON TV brings the world to your armchair with "SEE IT NOW" featuring Edward R. Murrow, Tuesday evenings on most CBS-TV stations.

ALCOA ALUMINUM

ALUMINUM COMPANY OF AMERICA

KC-97G STRATOFREIGHTER in production test flight. Plane serves as tanker-transport, cargo, troop, evacuation ship.



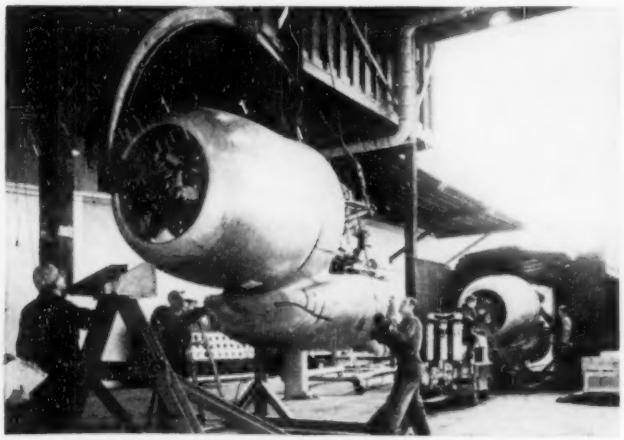
MAIN BODY SECTION on line shows double lobe configuration.

C-97: Still

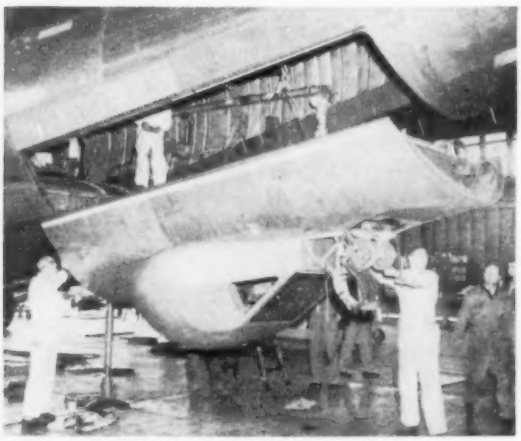
Boeing Airplane Co. has rolled up an impressive production record with its versatile C-97 Stratofreighter tanker, cargo hauler, transport.

Last Feb. 8, the 500th Stratofreighter was rolled out of Boeing's Renton, Wash., factory—the production rate was one airplane per working day.

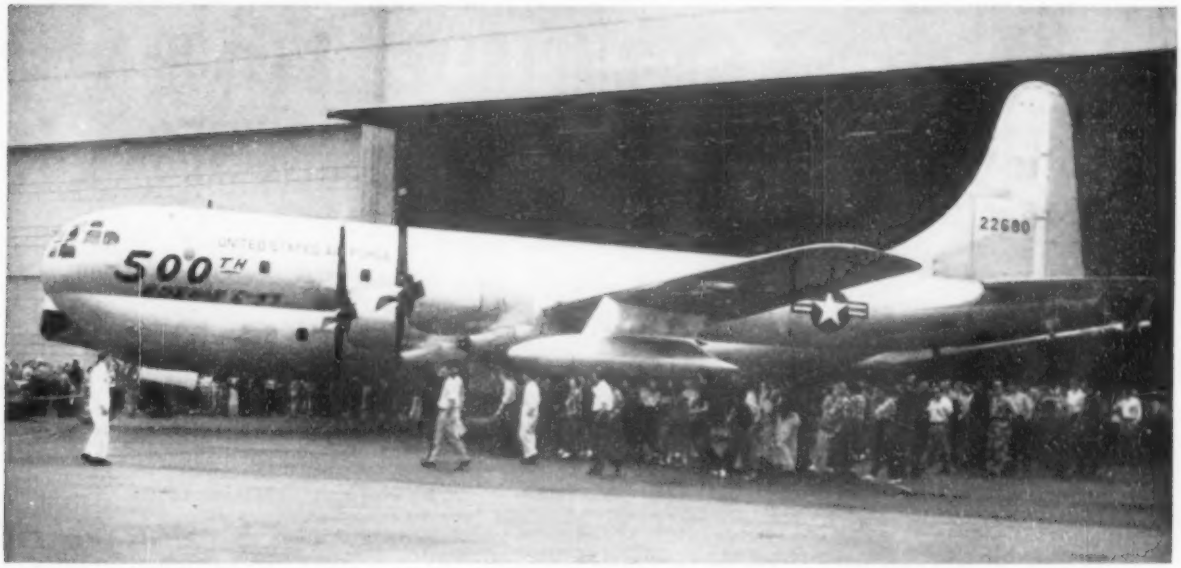
More than 5,000 people are involved in production at the Renton plant. Also contributing to the program are more than 200 subcontractors and vendors. Ryan Aeronautical builds the entire rear fuselage, tanker boom pod, floor beams and other components. Rohr Aircraft makes the power pack built around the Pratt & Whitney Aircraft 3,500-hp. Wasp Major.



POWER PACKS enclosing Wasp Majors are ready for mounting.



BOOM OPERATOR'S POD attaches to aft body.



500TH STRATOFREIGHTER rolls from Boeing's Renton production line under a rate of one double-decker per working day.

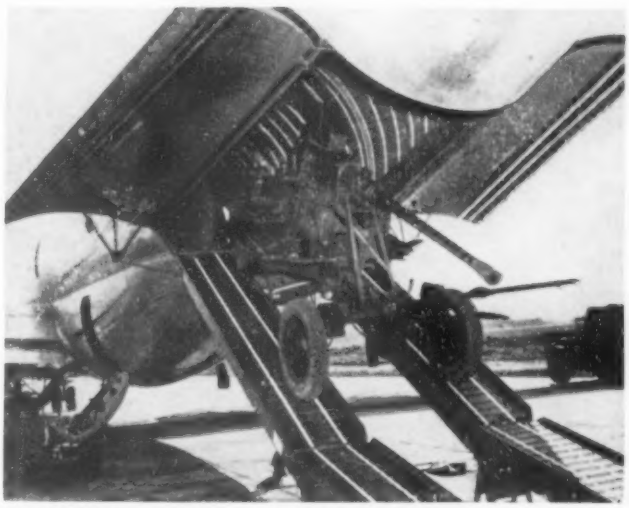
Going Strong

Current Stratofreighter models—KC-97Gs—are being delivered to Strategic Air Command. To each 45-plane wing of Boeing B-47 Stratojets, 20 of the KC-97s are allocated. These serve as cargo and personnel transports, as well, for SAC units.

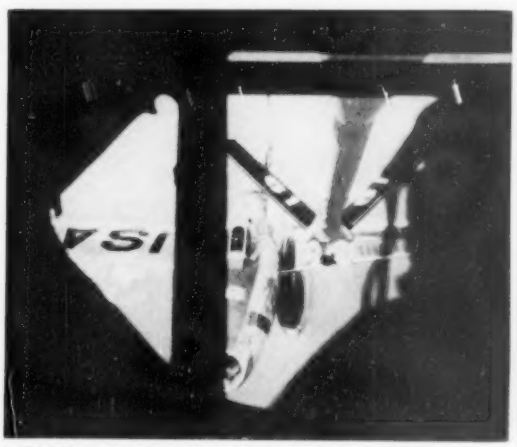
Military Air Transport Service uses the Stratofreighter for scheduled cargo and passenger flights across the Pacific between the U. S. and Japan. The plane also hauled wounded from the Korean theatre.

A Stratofreighter fitted with P&WA T34 turboprops is slated to fly late this year.

Boeing also has built 56 Stratocruisers for the airlines. This is the commercial version of the versatile C-97.



CLAMSHELL cargo door accommodates loading of Bofors gun.



FLYING BOOM on KC-97 refuels thirsty F-84G.

AIR EVACUATION C-97 wings casualties home from far base.

G.E. DEVELOPS 400-AMPERE GENERATOR TO MEET NEEDS OF NATION'S AIRLINES

A compact new 400-ampere generator requiring only six inches of cooling air over a range of 4500-7000 rpm has been developed by General Electric to meet the needs of the nation's airlines.

First application of the new d-c generator is on the Douglas DC-7. All electric power aboard America's newest airliner is supplied by four of the new 30-volt, 400-amp G-E generators.

The new generator (Model 2CM244) has the highest capacity of any wide-speed-range commercial unit of its size (6½-inch frame). Resulting from G.E.'s continuous interest in the requirements of commercial airlines, the new equipment offers these *exclusive* features:

- QUICK-ATTACH-DETACH (QAD) mounting flange permits installation in minutes instead of hours.
- CLEARANCE-TYPE SHAFT absorbs engine drive vibrations and reduces spline wear to insure longer life and reduced maintenance.
- SHRINK-RING COMMUTATOR permits higher speeds without commutator distortion to provide greater service life.
- NEW CORED BRUSH, a distinct advance in aircraft brush design, eliminates pre-filming of commutator, improves commutation, and reduces commutator temperature.

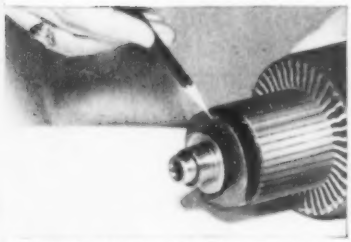
The new aircraft generator also offers these improvements:

1. Silver-plated, cast-bronze brush holder minimizes brush chatter and increases contact efficiency.
2. Solid-steel armature binding bands securely hold end turns and prevent winding distortions.
3. Pre-lubricated clearance-type shaft (internally lubricated) provides for increased operating life.

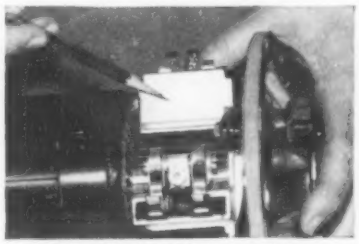
Whether your requirement is a-c or d-c, a single generator, or complete electrical systems, contact your General Electric aviation specialist, or write Section 210-85, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

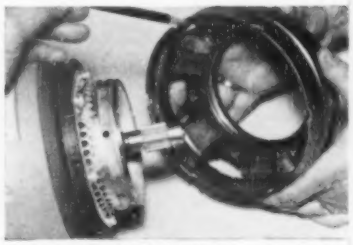
Exclusive features of new G-E generator on DC-7



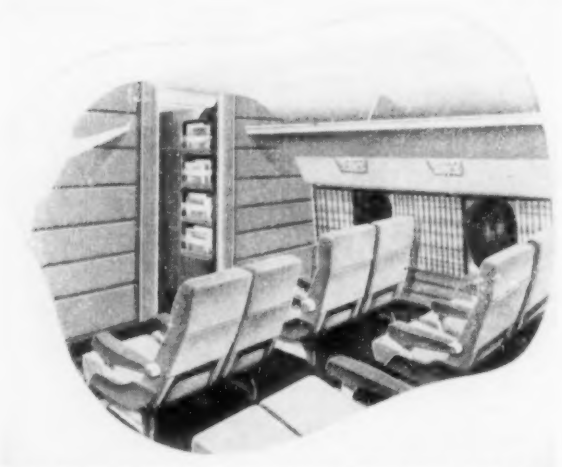
SHRINK-RING COMMUTATOR withstands higher speeds without distortion to insure long service life.



CORED BRUSH eliminates pre-filming of commutator, improves commutation and reduces commutator temperature.



QUICK-ATTACH-DETACH mounting flange sharply reduces time required for generator removal or installation.



TCA VISCOUNT CABIN, looking like this after Butler-Zimmerman redesign of the interior, compares with . . .

BEA VISCOUNT CABIN, which is the standard interior that Vickers furnishes for the turboprop transport.

Design Firm Gives Planes 'New Look'

New York consultants have finished face-lifting plans for British transport ordered by Canadian line.

By George L. Christian

Butler-Zimmermann, Inc., industrial design consultants, have completed all work preparatory to refurbishing the interiors of Trans-Canada Air Lines' 15 soon-to-be-delivered turboprop Vickers Viscounts.

The New York consultants have handled a large number of aircraft, both for the airlines and for executive and corporate users. This job holds special interest because of its international aspect—a Canadian airline engages a U.S. design consultant to do the interior of a British aircraft.

▶ **Start From Scratch**—Charles Butler, working with J. T. Dyment, TCA's director of engineering, spearheaded the Viscount project for BZ. He gave AVIATION WEEK full details of the work to be done on the planes.

BZ started from scratch, with a bare fuselage, and worked out all interior appointments—head liner, hat rack, window trim and curtains, dado, floor covering, seats, vestibule, coat closet, magazine racks and toilets. The galley was a TCA design on which BZ made some minor changes.

▶ **Neat and Crisp**—The treatment of the interior emphasizes these aspects of design: make it practical; make it easy to maintain; make it smart, yet pleasant and restful; make it functionally sound and utilitarian.

Maintenance was reduced by using vinyl-impregnated Fiberglas cloth, which is easy to clean. Also all passenger service items such as call bells, reading lights and ventilator ducts were consolidated in individual, hinged, easy-to-service panels.

Butler aimed to produce a pleasant, restful interior by designing the overhead contours with smart lines, hat rack angles with crisp radiuses, eliminating so-called "lazy curves." His object was to create the appearance of a well-organized, ship-shape cabin, trim to the eye and comfortable to inhabit.

Clean lines and an impression of spaciousness were prime considerations. Example was the narrow passageway from the front of the cabin to the two washrooms and the cockpit. The hall's width is only 24 in. But Butler wraps a walnut panel around each corner of the passageway in an easy curve, extending the walnut six inches away from the opening on either side, and the 24-in. opening takes on the look of a 36-in.-wide door.

Functional aspects of the design express themselves in ample, semi-cantilevered hat racks, large enough to carry an abundance of blankets, coats and the like. Rack is divided into 5-ft. bins by vertical partitions. The entire edge is trimmed with an attractive, extruded aluminum handrail.

▶ **Fewer Exits**—As originally built, each of the Viscount's 20 cabin windows was an emergency exit. This was possible because of the unusually large window dimensions—approximately 28 in. high and 20 in. wide.

TCA felt that so many exits were unnecessary and cut the number to four, two on each side. This pleased Butler, from the standpoint of appearance, because it meant he could eliminate 16 unsightly window placards giving emergency evacuation instructions in two languages. Sixteen sets of protruding hardware for opening the windows were also discarded.

The Butler-designed placards omit the word "Emergency." The word is unnecessary, Butler says, and only serves to worry nervous passengers. The new placards speak for themselves without shouting, he points out.

To work the emergency exits, the panel flips up easily, thereby exposing a handle which is used to release the window.

▶ **Strong and Clean**—Two important considerations in the interior design were the selection of strong, easy-to-clean materials and colors that would appeal to the passengers.

Durability will be achieved by use of Duracote, a Fiberglas-cloth base impregnated on both sides with vinyl. Duracote is flameproof, impervious to moisture and temperature changes, and is easy to clean by simply wiping off. It comes in a great variety of grains, finishes, colors and weights. One drawback is that it is hard to install, Butler says. It is made by Duracote Corp., Ravenna, Ohio.

Colors chosen for the aircraft were especially blended with an eye towards

making them harmonize with colors considered typical of Canada, according to Butler. Even names given these colors were chosen because of their Canadian connotation. The four basic lines are Fern green, a bland, soft shade; Folkestone grey; Beaver, a light brown used on the dado; and Catawba, a rich, dark brown used for the floor covering.

Window curtain and wardrobe curtain materials were especially woven—the former is in a pattern called Dominion Plaid, and the latter in Dominion Leaf, which has the traditional Canadian maple leaf design woven in.

▶**Into the Vestibule**—Entering the main cabin at the rear of the plane, the passenger faces the galley. This is mostly covered by Kalistron vinyl panels made by U.S. Plywood. (In Kalistron the color is coated on the back of a clear vinyl sheet, so there is the full thickness of the clear plastic to protect the color of the panel.)

At the right is a large pull-out clothing carrier for coats. At the left, a Fern green bulkhead, containing the stewardess' seat, divides the last row of seats on the left from the vestibule.

▶**Into the Cabin**—The original head liner, with its athwartships seams, was replaced with a design emphasizing a sweeping fore-and-aft treatment.

A flat ceiling helps to generate the impression of length. The metal-frame-and-net baggage racks have given way to the semi-cantilever structures. Meeting of side wall and hat rack forms neat angles instead of undulating curves.

Combination of an unusually low dado line—about 18 in. above the floor—and large windows gives the passenger an excellent view.

▶**Service Panel**—In consolidating all passenger service items into a single panel, Butler incorporated these features:

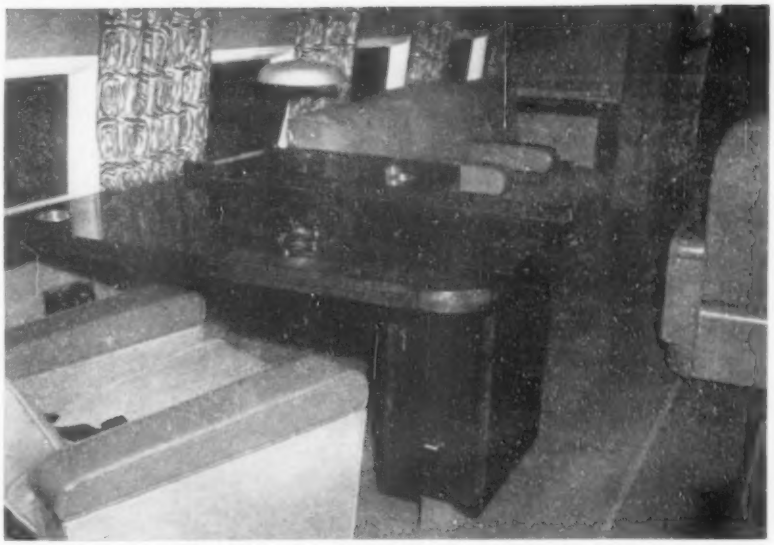
• **Hinge at the bottom.** This allows panel to be lowered easily for inspection and maintenance. If a bulb burns out in flight, the stewardess can quickly re-lamp the unit.

• **Aluminum construction.** This makes cleaning the panel simple. All these and other electrical cabin fixtures were made by Luminator, Inc., of Chicago.

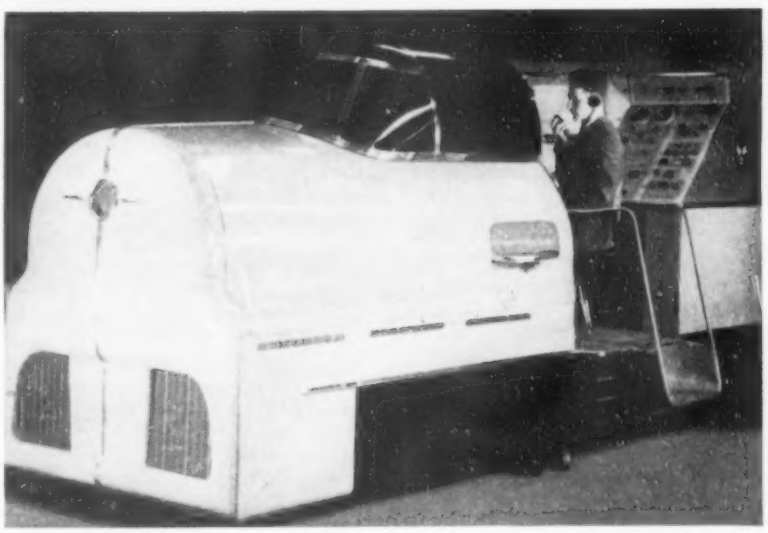
▶**Cabin Color Scheme**—Butler laid out this color treatment for the cabin: floor and kick bases are Catawba. From kick bases to dado level, padded and quilted Beaver. This motif is carried around to forward bulkhead. (The padding helps reduce cabin noise level, besides looking good.)

From top of the curtains up, cabin wall, bottom of the hat rack and head liner are Folkestone grey.

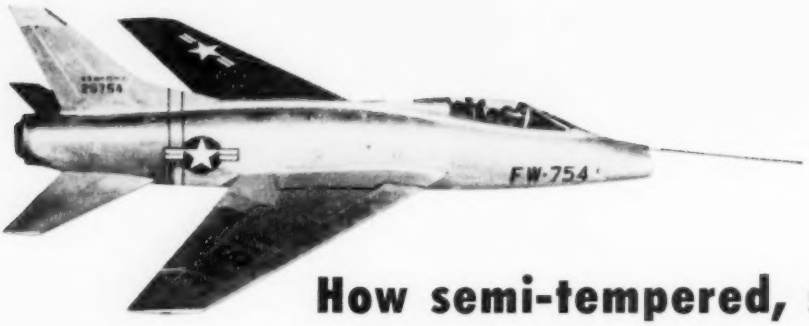
Head-liner contour was designed to create a 30-in.-wide flat panel running fore and aft. This gives a long sweep to the cabin and enables Butler to get away from the elongated tube appear-



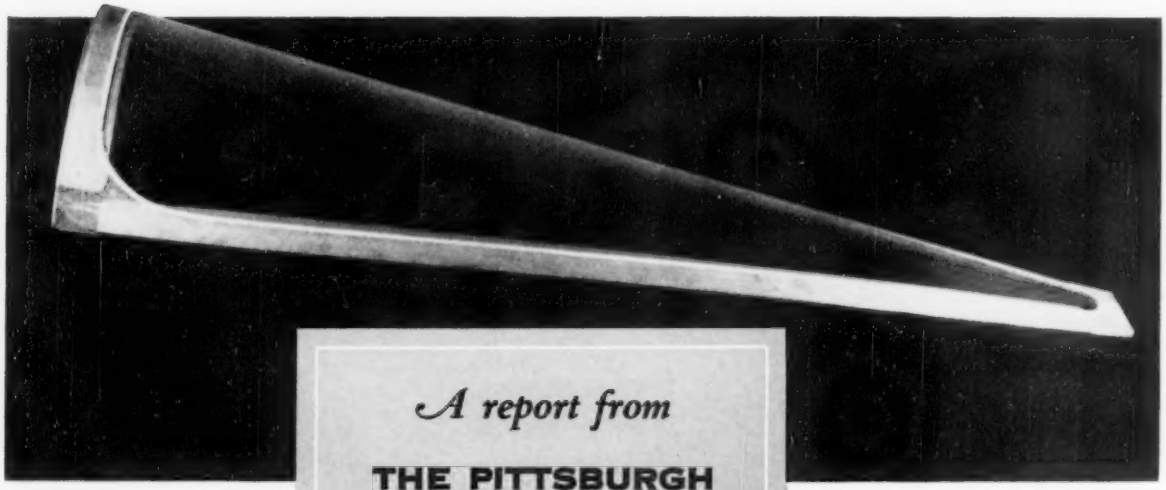
THESE PLUSH QUARTERS are in cabin of Bendix executive DC-3 styled by BZ.



RESTYLED LINK JET trainer (bottom) makes compact unit. Electronic gear (large box, left, middle photo) is under floor of redesigned trainer.



How semi-tempered, single curved Flexseal Duplate is used in the North American F-100 Super Sabre



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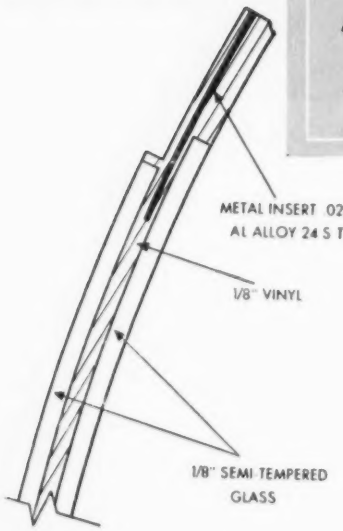
THE PITTSBURGH AIRCRAFT GLAZING FILE



THE North American F-100 Super Sabre is America's first supersonic operational jet fighter. This sleek aircraft with its swept back wings has a service ceiling of above 50,000 feet and a combat radius of more than 500 miles.

Metal insert Flexseal Duplate is used in the F-100's side windshields as indicated in the section at left. It consists of two plies of 1/4" thick semi-tempered polished plate glass and a .125" vinyl filler. The overall nominal thickness measures .369".

The 500 sq. in. windshields measure 18 1/4" x 41 5/16". They have a depth of 3 3/16" with a radius of bend of approximately 14".

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ance that goes with curved head-liner design. Square dome lighting fixtures extend slightly below the flat panel at intervals.

► **New Seats**—The new seats in the Viscounts save 500 lb. in weight (each double seat weighs 47 lb.), and their open-arm, lounge-chair-type design makes folding the seat easy. Back folds forward and arm collapses in a parallelogram arrangement.

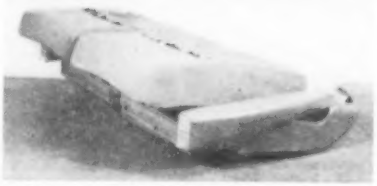
By the open-arm design, air circulation is increased, giving the passenger added ventilation and comfort, Butler says.

Each pair of seats has an uninterrupted clear space underneath. There are no obstructions between the two leg supports at either end. Aerotherm Corp., Bantam, Conn., manufactured the seats, which were styled by Butler.

► **Front End**—Forward bulkhead has been upholstered in padded Fern green Duracote. Horizontal piping is grey. From the dado line down, covering is Beaver brown.

The pickled walnut paneling which wraps around the narrow door extends forward on either side of the vestibule and includes the doors into the two facing lavatories and the one leading to the cockpit.

Small, edge-lit, transparent plastic signs show if the wash rooms are occupied. Signs were installed in such a way that no holes had to be cut through bulkheads.



SEATS for TCA Viscounts are collapsible, give passengers more leg room.

The front vestibule is indirectly illuminated and the light shines forward to keep it out of the passengers' eyes.

Two four-shelf magazine racks are built into either side of the forward vestibule.

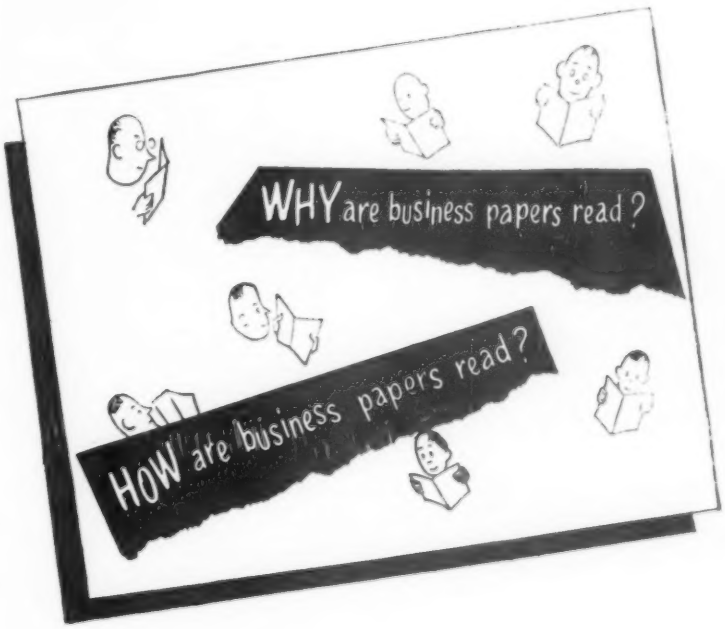
Butler saved money on the lavatory wash basins. A standard airline wash basin costs upward of $300. Butler went to a New York plastics fabricator, Durable Formed Products, who made dies for the basin for about $500, then knocked out the basins themselves for about $7 apiece. Units are made of an opaque white plastic, closely resembling porcelain. It gives a neat appearance and is simple to clean.

To get away from fragile, easily broken plumbing fixtures, Butler called for standard household water faucet fixtures.

► **Other Customers**—Butler-Zimmermann have handled the same kind of job for two other commercial transports before tackling TCA's Viscounts. The first was Northwest Orient Airlines' Boeing Stratocruisers, whose interior design and exterior paint job were Butler's first effort involving aircraft. Next came all the Martin 4-0-4s delivered to Eastern Air Lines and Trans World Airlines.

In the military field, BZ handled the human engineering in such areas as the cockpit and crew quarters of the Martin P5M and XP6M flying boats, and the gondola interior of the Goodyear ZPN series blimps.

Another branch of the aviation industry in which BZ has done design work is electronic flight trainers. Among these are Navy SNJ trainers and Air Force jet trainers manufactured by Link



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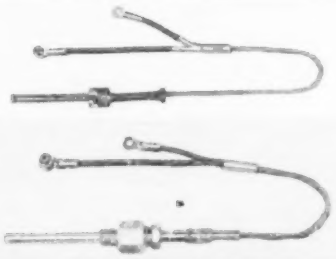

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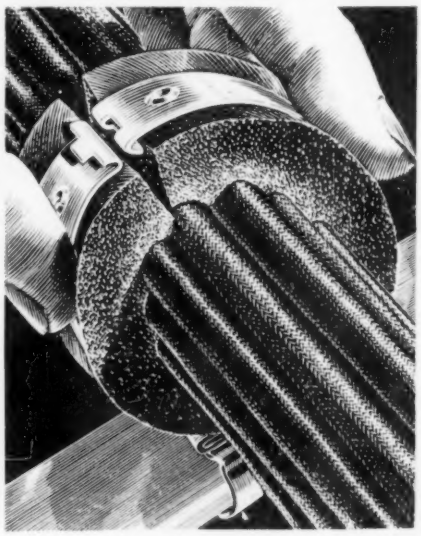

Available with swivel (above) rivet, snap-fastener or snap-on clip mountings.

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Aviation, Inc., of Binghamton, N. Y. Styling was done by Paul Zimmermann and Butler.

The firm has handled large numbers of corporate and executive aircraft. Its customers include General Motors, Alcoa, Thompson Products, American Can, Atlantic Refining, U.S. Rubber, Bendix Aviation and Republic Aviation.

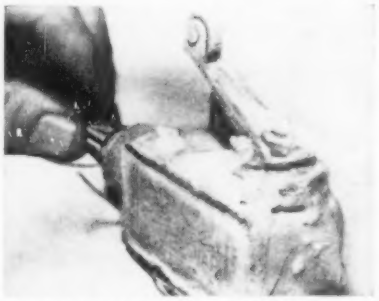
Butler and Zimmermann, who formerly were with Raymond Loewy, the design consultant, set themselves up in business early 1948 while working on NWA's Stratocruisers. They handle a large variety of items outside the aeronautical field, including railroad car interiors and styling of automobiles.

Hermetic Sealing of Switches Described

Los Angeles—Emphasis on hermetically sealed switches is increasing as the aircraft industry learns that changes in altitude, temperature or humidity have no effect on operation of the switch, J. O. Roeser, managing engineer of Electro-Snap Switch & Mfg. Co. told the Aircraft Electrical Society at a recent meeting here.

Pointing out the importance of hermetically sealed switches as compared with the conventional die-cast enclosed switch, Roeser cited the experiences of fighter pilots in Greenland. Failure of the landing-gear "down lock" limit switch was so common, he said, that its occurence was reported to the control tower as "routine emergency on landing gear."

"Any device whose function depends



ICE FORMATION on B36H hermetic-sealed switch (shown in depressed position in top photo) does not prevent switch release (bottom).

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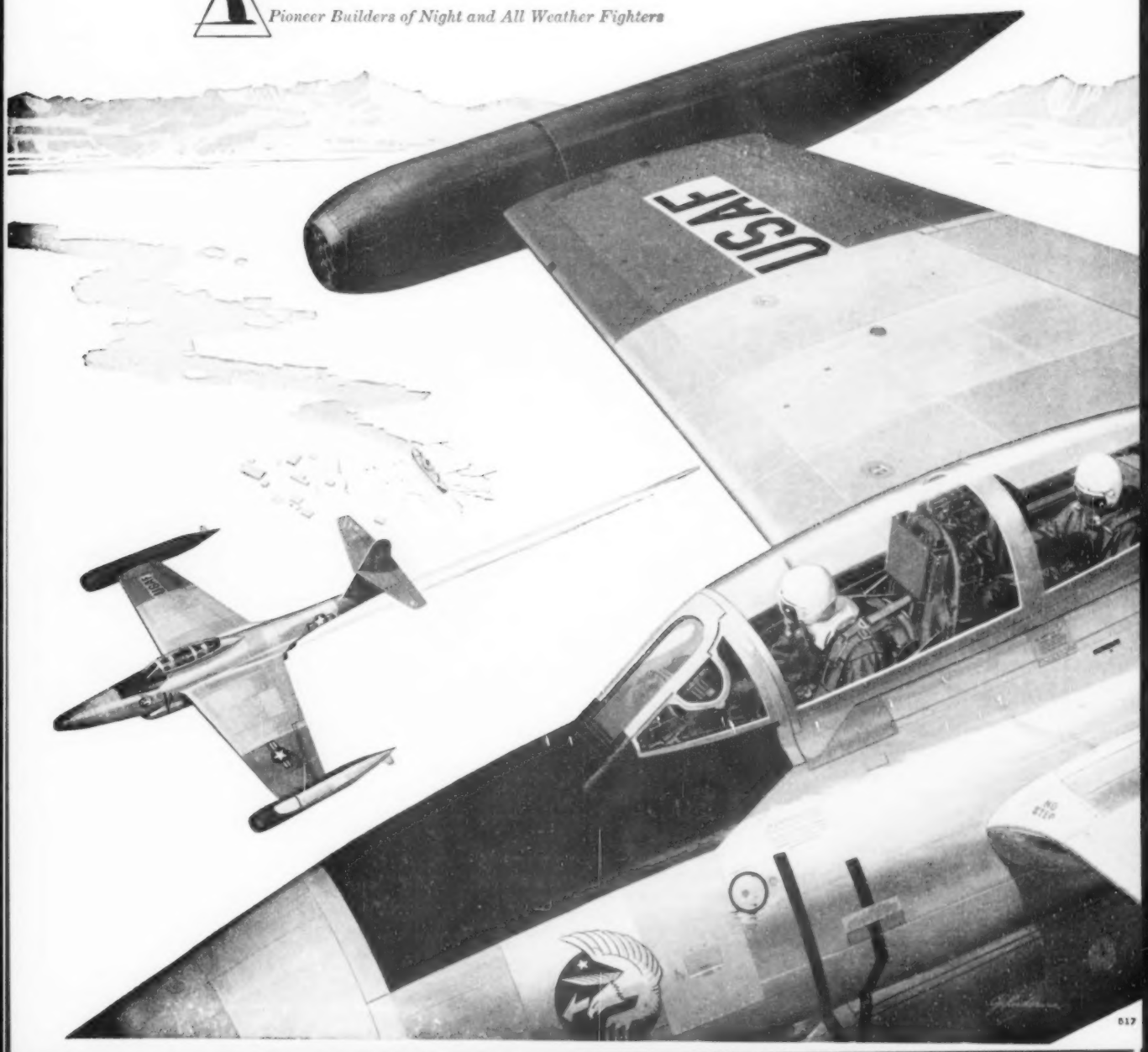

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on free action of small parts involving comparatively small forces should be sealed," Roeser said.

He explained that pressure changes due to altitude will force moisture into any enclosure that is not hermetically sealed. The extremely low temperatures common to aircraft then freeze the moisture with resultant sticking of the mechanism.

"Today we have the knowledge to seal almost any device even if it requires a mechanical entrance to the enclosure," Roeser said.

Early seals were made by spot welding, silver solder, solder dipping, or soft solder—none of which was completely satisfactory. He told the group "steel enclosures are now copper brazed in an inert atmosphere to effect a strong joint that is leak tight and will remain so despite abuse."

Roeser pointed out that the switch container is made of steel, due to its relatively low permeability and ease of fastening members to it by copper brazing. Glass beads—compression glass due to its ruggedness—are used to carry the wires through, he said.

"The big problem has been the mechanical entrance to the enclosure. The motion of the actuator must somehow reach the sealed switch," Roser said.

After many approaches, he said, Electro-Snap found the answer in a Teflon and silicone rubber bonded seal which will operate more than two million cycles without leaking and which is reliable under all conditions.

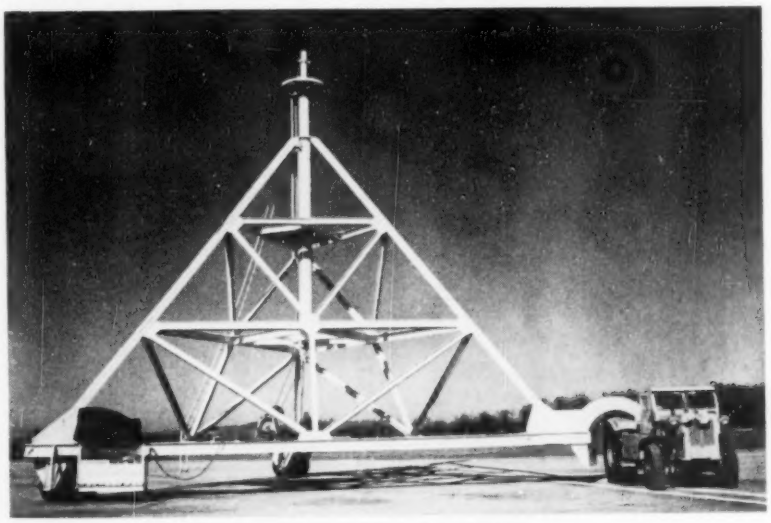
To assure a tight seal during the life of the hermetically sealed switches, the company uses the mass-spectrometer for leak testing.

His firm's hermetic switches are presently being used on the McDonnell Demon and Voodoo, Convair B-36 and F-102, Douglas B-66, Grumman F9F, and others, Roeser said.

OFF THE LINE

Details have reached this magazine concerning the recent accident in which a Sabena Airlines' steward was sucked out the door of a Convair 240 flying at about 1,500 ft. near Geneva. The steward went to investigate when the green light showing the door was properly latched turned to red shortly after takeoff. The door blew partially open and he was sucked into the airstream and hit by one of the props. Sabena's 240s do not have the integral passenger loading ramp.

Bartow patent covering high-intensity runway lighting was upheld recently by U. S. District Court for the District of Texas, the Welsbach Corp. reports. Ruling in the suit brought by Welsbach and Bartow Beacons, Inc., against the city of San Antonio and the H. B. Zachry Co., the court held the patent valid and ordered the defendants to pay the standard royalty of 26 cents per foot of lighted runway.



Mobile Mooring Mast

New type of mobile mooring mast makes it easier to handle huge Navy non-rigid airships on the ground. The mast is hooked on to a diesel-powered tractor by means of a goose-neck drawbar assembly, which is said to give the combination greater tractive power and maneuverability in forward, reverse and short-turn movements than old-style mobile masts. The mast is capable of handling ZPK, -M and -N-type airships, ranging from 527,000 to 975,000 sq. ft. in size. The mast was a joint project of Goodyear Aircraft Corp. and the Navy, with assists from Caterpillar Tractor Co., Peoria; Ohio Machinery Co., Cleveland; and Athey Products Corp., Chicago.

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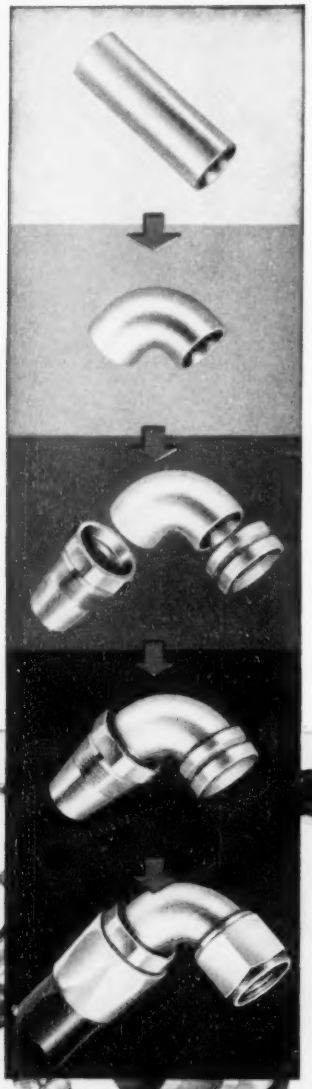

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Specify the elbow that will solve your problem, and Aeroquip will provide the answer, *fast!* With Aeroquip's advanced method of fabricating, thin wall tubing is bent to specification and other components are brazed into an assembly of uniform strength. Features are: extremely tight bend radii, uniform wall thickness, unrestricted flow, and exceptionally light weight. Sizes range from ¼" O.D. to 3" O.D.

Thousands of Aeroquip brazed aluminum elbow fittings are in use on aircraft and engines with 100% user satisfaction. These assemblies are matched with Aeroquip hose for guaranteed performance. Call on us for a quick solution to your plumbing problems.

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Manufacturers of Aeroquip Flexible Hose Lines with detachable, reusable Fittings; Self-Sealing Couplings; Brazed Aluminum Elbows

LOCAL REPRESENTATIVES IN PRINCIPAL CITIES IN U.S.A. AND ABROAD • AEROQUIP PRODUCTS ARE FULLY PROTECTED BY PATENTS IN U.S.A. AND ABROAD

RCA View on Atomic Battery Challenged

Ohmart disputes claims of efficient power production; GE research chief protests unit's high operating cost.

By Philip Klass

Quick rebuttals have greeted claims by Radio Corp. of America that its recently announced atomic battery is the "first direct conversion of nuclear energy to usable electricity" and a potential threat to more conventional means of generating electric power. The RCA development was sponsored by USAF's Wright Air Development Center.

One of the rebuttals came from Philip E. Ohmart, who says he discovered the direct conversion phenomenon in June 1950, while employed in an Atomic Energy Commission lab. His company has been building atomic cells for several years (AVIATION WEEK Dec. 24, 1951, p. 26).

Another rebuttal comes from a General Electric spokesman, who sharply challenges RCA's speculation that huge atomic batteries may some day replace conventional powerplants or supply individual household needs.

▶ **Basic Limitation?**—The present RCA atomic battery, which uses a radioactive isotope (strontium-90) and a semi-conductor (germanium or silicon) in combination, has a shortcoming which might prove serious. Electron bombardment from the radioactive material damages the important semi-conductor crystal structure upon which the battery operation depends.

RCA is currently investigating the seriousness of the damage and possible ways to prevent it.

▶ **Low Power Device**—If crystal damage can be alleviated, the RCA atomic battery could find use in certain transistorized avionic equipment, such as air rescue beacons, where power consumption is low and indefinite battery life is important. However, GE's Dr. Guy Suits, vice president in charge of research, takes a dim view of the atomic battery as a source of appreciable power.

Based on present AEC prices for strontium-90 and presently known semiconductors, Suits says it would cost $142,000 to produce one kilowatt-hour of power by atomic battery. (Cost of generating electricity by conventional means: about one cent per kwh.)

Even if large-scale production of atomic wastes were to cut cost of strontium-90 to $2 per curie (an RCA estimate), atomic battery power would cost $570 per kwh., Dr. Suits says.

▶ **Principle of Operation**—The RCA cell consists of a wafer of germanium or silicon in which an impurity has been added to form a junction. The junction is similar to that used to make transistors, but has a larger area. A thin layer of strontium-90 is spread on the semiconductor wafer. Beta particles (electrons) released by the strontium penetrate the wafer, each producing an average of 200,000 "slower electrons" in the semi-conductor, RCA says. The process resembles the familiar photo-cell in which semi-conductor electrons are released by light radiation.

In theory, virtually any radioactive material could be used. Strontium was selected because it is one of the most abundant materials resulting from uranium fission in a reactor, has a long life (half-life of 20 years), and because it needs relatively little shielding.

▶ **Battery Performance**—The present RCA cell delivers approximately one microwatt (5 microamp. at 0.2 volt), using 50 millicuries (1/300 of a cubic centimeter) of strontium. Efficiency of the present cell (ratio of electric power generated to the energy of radioactive electron emission) "exceeds 1%," RCA says, adding that "an efficiency of 10% appears to be a reasonable goal."

Ohmart also challenges RCA's claim that its cell "produced usable electrical power a hundred times more efficiently than any previously reported radioactive generator." Ohmart says his earliest cell had an efficiency of 0.4% and that more recent versions run 1.6%.

▶ **The Ohmart Cell**—The Ohmart Corp. nuclear cell differs from the RCA unit in some respects. Electricity is generated by the ionization of a gas from radioactive bombardment.

The Ohmart cell is basically a high-impedance device; the RCA cell a comparatively low-impedance source. However, Ohmart told AVIATION WEEK that his basic patent application, now pending, covers the use of ionizable liquids and semi-conductors in addition to gases.

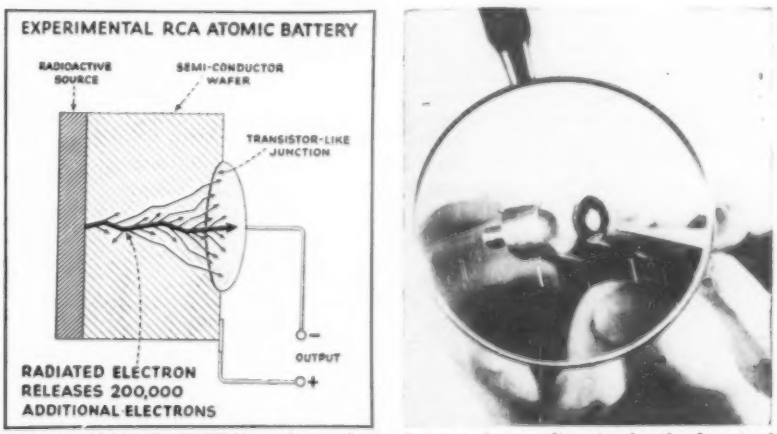
His company has produced cells capable of supplying several microwatts of power of 0.7 volt, Ohmart says, but devotes most of its efforts to low-power cells for instrumentation use.

In one application, these are used to measure the thickness or density of materials. Another development, for USAF, is the design of constant-voltage and constant-current cells for reference purposes in avionic equipment.

▶ **Future Potential**—A qualified scientist in another company says that atomic batteries are "not a promising economical energy source . . . (because) the the recovery and use of this energy (radioactive wastes) is very expensive . . . (and because) much less than 1% of the total fission energy is available in the kind of radiation used in the RCA cell."

Admitting that new knowledge of semi-conductors will improve the output of such cells in the future, this same scientist adds that "gaining an additional factor of even as high as 10 is highly speculative."

▶ **Crystal Structure Damage**—An RCA scientist told AVIATION WEEK that "we do not know how serious is the problem



RCA ATOMIC BATTERY produces electrical power from radioactive bombardment of semi-conductor wafer. The battery's two basic elements are shown magnified at right.

of crystal damage from radioactive bombardment."

The company is investigating other radioactive wastes with lower electron velocities, which would be less damaging than strontium. One such material is tritium, an unstable version of hydrogen.

▶ **Another Voice**—The February issue of the Transistor Research Bulletin, published by the National Scientific Laboratories (a private organization), summarizes the present state of the atomic battery art by pointing out that an atomic automobile battery would occupy a space of a 10-foot cube, cost $8 million, and, at today's production rate, would require all germanium output for the next nine years.

Despite these pessimistic appraisals, RCA spokesmen are standing pat. They point to those who first scoffed at the future possibilities of the airplane and they are optimistic that future developments will fulfill present expectations.

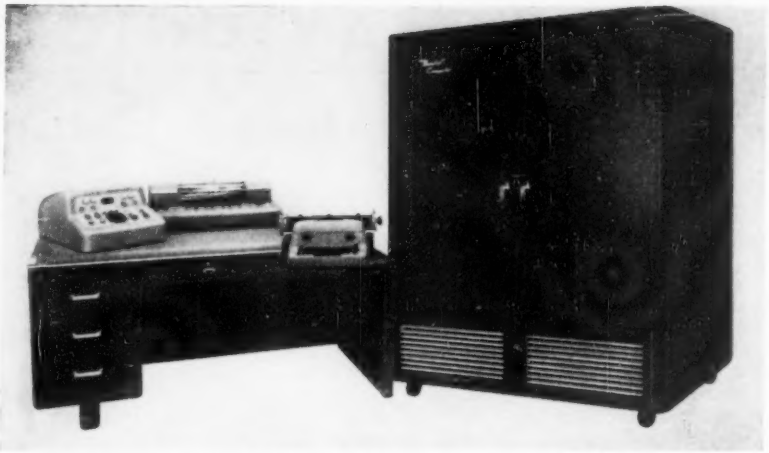
New Power Supplies, Frequency Converter

A new frequency converter and several new power supplies, suitable for laboratory and/or computer use, have recently been announced:

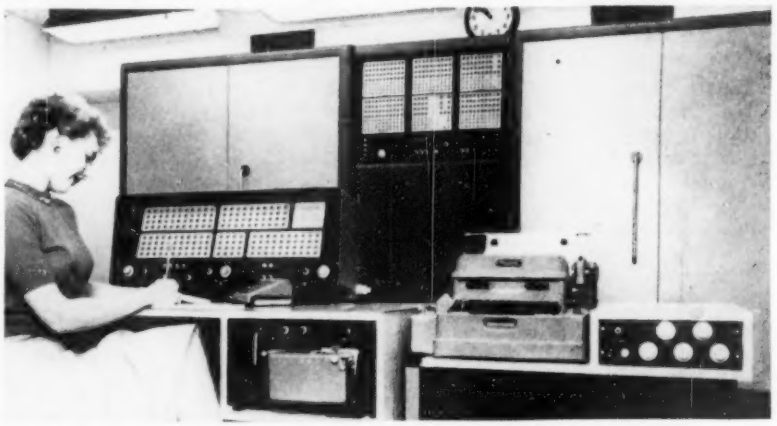
• **Frequency converter,** Model 2500, delivers 60 va. of regulated 2,500-cps. power, operates from 90-115 v. a.c., 60 cps. Output voltage, adjustable between 90 and 115 v., is regulated to within ¼%, frequency to within 0.04% and total harmonic distortion is less than 1%, according to manufacturer. Avion Instrument Corp., div. of American Car & Foundry Co., 299-44 State Highway No. 17, Paramus, N. J.

• **Regulated d.c. supply,** Model MR532-15, uses magnetic amplifiers, provides 15 amp. at 5 to 32 v. d.c., regulated to 1% over input voltage range of 105-125 v. a.c. Ripple voltage is 1% rms. at 32 v., full load, and recovery time is 0.1 sec., according to manufacturer. Model MR1032-50, rated 50 amp., 10-32 v. d.c. operates from 220 v. a.c., has similar performance for input voltage variation of 10%, according to manufacturer. Perkin Engineering Corp., 345 Kansas St., El Segundo, Calif.

• **Precision computer power supply,** Stabvolt Type C, using magnetic amplifiers for regulation, is available in ratings of 1.5 to 500 v. d.c., 1-100 amp. Dynamic regulation is reportedly better than 0.1% for step-change of a.c. line voltage from 95 to 135 v., or for line frequency variations of 57-63 cps. Regulation of 0.2% is quoted for step change for 20% in d.c. load current, and ripple of less than 0.2% rms. Manufacturer is Magnetic Research Corp., 318 Kansas St., El Segundo, Calif.



BENDIX Computer Division's differential analyzer has capacity for 60 integrators.



ELECTRODATA CORP.'S Model 203 can perform 500 additions per second.

New Digital Computers Developed

The number and type of highspeed computers available to industry continues to grow. Two new electronic digital computers, in what the manufacturers describe as the medium-price range, have been announced by Bendix Computer Division and Consolidated Engineering Corp.'s new wholly-owned subsidiary, ElectroData Corp.

• **Bendix Computer's** digital differential analyzer, operating in a decimal number system, can be used to solve linear and non-linear differential equations or simultaneous sets of such equations. It may also be used for integral equations, split-boundary value problems, and individual or simultaneous sets of linear or non-linear algebraic and transcendental equations, the company says. Bendix gives no price for the new computer, but says it is moderate.

• **ElectroData Corp.'s** Model 203 is a highspeed calculating machine capable of performing additions, subtractions and logical shifts at an average rate of 500/sec., multiplications at 120/sec. and divisions at an average rate of 85/sec. Basic computer is priced at $130,000.

▶ **Differential Analyzer**—The Bendix computer has a capacity for 60 integrators and an iteration rate of 100/sec. If problem requires only 30 integrators or less, iteration rate may be doubled. The machine can be programmed from punched tape or a manual control panel; output (solution) is recorded on punch tape.

Bendix says that critical electronic components have been derated 50% to insure reliable operation and that etched-circuit plug-in assemblies are used to ease maintenance. A descriptive brochure may be obtained by writing company at 5630 Arbor Vitae St., Los Angeles 45, Calif.

▶ **General Purpose Computer**—ElectroData's machine operates serial fashion in binary coded decimal number system. A magnetic drum, rotating at 3,600 rpm., provides a storage capacity of 4,080 ten-digit words. One section of the drum, with a capacity of 80 words, gives an average access time of

SPECIFICATIONS

Tubes Cooled
4X150A, 4X150G
5508 and 6161

Altitude
Up to 50,000'

Fan Model
Joy Axivane
AV-3.5-2.75-120D

Size
3½" diameter

Weight
5 lbs.

Duty
60 CFM @ 5" WG

Motor
27V DC—4.7 Amps.

Only a JOY AXIVANE® FAN can handle this Electronic Tube cooling job at altitudes up to 50,000 feet

Cooling the above-specified tubes in airborne applications is a critical problem because of the extremely light air. The difficulty is particularly severe at elevations of 40,000 or 50,000 feet.

An extensive series of tests were recently initiated in an attempt to determine an effective cooling process. The tubes and sockets were mounted in pairs in a special cabinet designed to equalize the air distribution for each tube. The problem was to discover a method of heat dissipation that would hold the temperature of the glass-to-metal seals below the design operating level.

Of all the blowers tested, only this Joy AXIVANE fan was able to meet the rigid specifications. The tubes were cooled with 25°C air at an elevation of 50,000 feet, easily surpassing all requirements.

This is just one of an extensive line of AXIVANE fans specially designed for economical efficiency in cooling electronic equipment. All are built of aluminum and magnesium for light weight, sturdily constructed for maximum resistance to shock and vibration, and feature the space-saving compactness inherent in vaneaxial design.

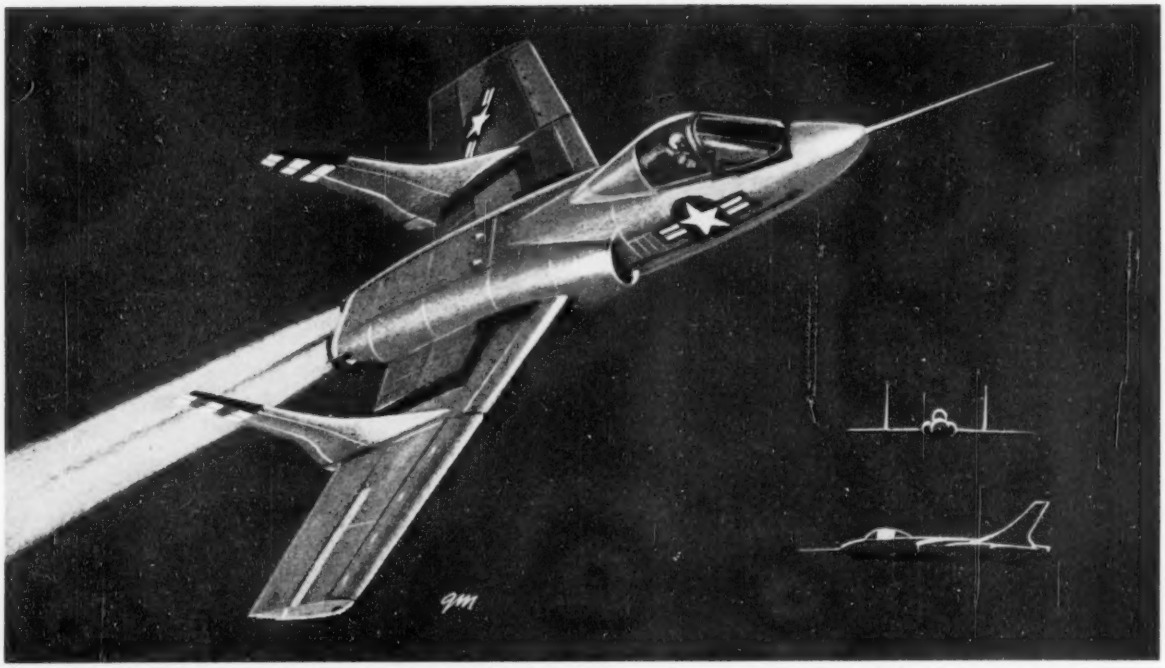
Each fan can be modified to fit individual requirements for cooling all types of electronic equipment under any conditions. Let us help solve *your* problem. ● *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

JOY

WORLD'S LARGEST MANUFACTURER OF VANE-AXIAL TYPE FANS

WBD 1-4640



The F7U-3 Cutlass designed to give the Navy a fast shipboard fighter offering superior performance, a greater rate of climb and a greater range of firepower.

Speedy and Fast-Climbing Navy Fighter

Chance Vought Aircraft's twin-jet F7U-3 Cutlass climbs from a carrier deck to a service ceiling of over 50,000 feet. Then this Navy fighter can level off and fly with full maneuverability at tremendous speeds.

It is a swept-back wing, tailless type airplane with vertical stabilizers and rudders at the edge of the wing. Leading edge wing slots and air brakes give it the low stalling speed essential for carrier-based aircraft.

Chance Vought Aircraft engineers provided the tremendous Cutlass power by installing two Westinghouse J46 engines, with afterburners, capable of developing approximately 12,000 lbs. thrust.

Naturally an airplane like the Cutlass needs unusual materials — combinations of corrosion resistance, heat resistance, strength and ductility are essential for sustained operations. Inco Nickel and Inco Nickel Alloys provide just those combinations in critical locations where their special properties are demanded.

Perhaps you have a metal problem calling for special properties. Inco's Technical Service Section will gladly assist you in finding a solution. Write for the information you want.

WHERE INCO NICKEL ALLOYS
ARE USED IN THE F7U-3

Inconel®
Shrouds
Heaters

Monel®
Rivets
Lockwire

Inconel "X"®
Bolts
Afterburner shell, rings, control rods

Inco Nickel Alloys

MONEL® • "R"® MONEL • "K"® MONEL • "KR"® MONEL "S"® MONEL • INCONEL® • INCONEL "X"® INCONEL "W"® • INCOLOY® • NIMONIC® Alloys NICKEL • LOW CARBON NICKEL • DURANICKEL®

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

0.85 millisecond. Average access time for the rest of the drum is approximately 8.5 ms., the company says.

An accessory magnetic tape storage unit can provide additional capacity, in 160,000-word increments, up to a total of 1.6 million words.

The Model 203 takes its input instructions from standard punch-card equipment or from a specially designed photo-electric reader which can insert 450 decimal digits per second into computer memory from previously punched tape. Computer output can be recorded on standard punch cards, tape, or be tabulated on an electric typewriter.

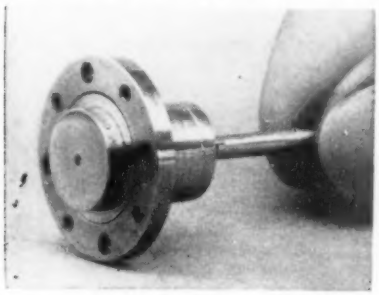
EDC says components are operated well under their rating to give good reliability. Built-in test circuits, preprogrammed subroutines which can be inserted to help diagnose malfunctions, and easily replaced plug-in units are other features aimed at simplifying computer maintenance.

Electrodata says it plans to build five Model 203s this year. More information can be obtained by writing for Bulletin CEC-3100. Company address 717 No. Lake Ave., Pasadena, Calif.

New Transducers Made Available

Recently announced pressure transducers include two with variable-resistance pick-offs and one with variable-reluctance pick-off:

• **Variable-resistance, Type 4-312,** available for measuring gage, absolute, or differential pressure. Absolute pressure units cover range of 10 to 150 psia., differential and gage pressure units cover range of 5 to 75 psi., for use with



maximum line pressure of 150 psi. Transducer hysteresis and linearity is 1% of full scale above 5 psi., 2% below, with temperature compensation over range of −65 to 250F, according to manufacturer. Unit weighs 20 grams. For more details, write for bulletin CED-1540. Consolidated Engineering Corp., 300 N. Sierra Madre Villa, Pasadena 8, Calif.

• **Variable-resistance, Model GPT,** available for measuring absolute, gage, or differential pressure in range of 15-80 psi., has linearity of 1% full

1st of a Series

...another

JET-HOT FASTENING PROBLEM

solved by Delron

Thermalectric Afterburner Safety Switch protects F-86D Sabre Jet from critical temperatures above normal operating range. 12 Dura-Loc 1600 High Temp Nuts, and 4 Delron High Temp Screws are used in this application.

Dura-Loc 1600 High Temp Nut for 1600° F. temperatures.

Delron High Temp Screw for minimum seizure and galling to 1600° F.

problem: Engineers at Thermalectric Engineering Company, Van Nuys, California, sought special fasteners to assemble and install Safety Switch on North American F-86D Sabre Jet Afterburner. Self-locking nuts and flat head screws had to withstand temperatures of 1600°F. Nuts were required to stay locked under extreme heat and vibration, yet present no problem on removal.

solution: Delron Dura-Loc 1600 High Temp Nuts and Delron High Temp Screws more than met requirements of this critical job, and are now specified by Thermalectric to safeguard the F-86D and its pilot. Nine years of service experience with millions of nuts have proven the safety, re-useability and labor-saving features of Dura-Loc Nuts and Delron Bolts and Screws.

This is another example of Delron's long service and design experience at work—solving critical fastening problems!

What is YOUR critical fastening problem?

THE DELRON COMPANY, INC.

5224 Southern Avenue, South Gate, California

AW-1

Clip this ad to your letterhead, and mail for product data on items checked:

☐ Fasteners to 1200°F. operation

☐ Fasteners to 1600°F. operation

☐ Sandwich structure fastening

Name_____

in the palm of their hand...

AEROTEC AUTOMATIC CONTROLS

Safeguard

the pilot and his plane

...Every major airframe manufacturer in the United States specifies AEROTEC Automatic Controls for at least one of his products. At today's trans-sonic speeds and split-second combat maneuvering, the pilot's very life and the safety of his plane are dependent upon these automatic controls.

Proved in thousands of military and commercial aircraft, AEROTEC Automatic Controls are today being specified by more and more manufacturers. These controls have passed extensive qualification tests *simulating actual flight conditions* in accordance with Spec MIL-E-5272 so that they can offer perfect performance under the most severe flying and combat conditions.

AEROTEC Automatic Controls for flap, landing gear and cabin heater applications, fuel transfer, flow indication, etc., have proved their performance record in flight, and have always given added safety to pilot and plane.

Let our qualified engineering staff help solve your automatic control problems. One of our specialists is near, ready to serve you. Call or write today.

When you think of Automatic Aircraft Controls, you should automatically think of AEROTEC.

Project Engineers

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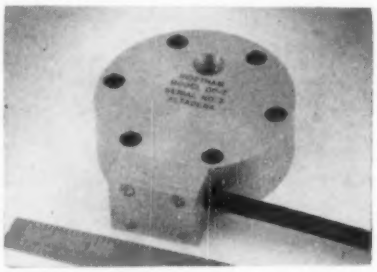
AIRCRAFT DIVISION — GREENWICH, CONNECTICUT

Designers and Manufacturers of Automatic Controls—*Valves:* Regulating, Relief and Check types—*Pressure Switches:* Gage, Altitude, Differential and Absolute Types—*Float Switches:* Top, bottom or side mounted—Single, Dual or Tandem.

scale, hysteresis under 0.5% full scale, operating range of —50 to 90C, according to manufacturer. Unit weighs 8 oz., dimensions are: 2 in. dia., 2¼ in. long. Genisco, Inc., 2233 Federal Ave., Los Angeles 64, Calif.

• **Variable-reluctance, Model DP-7,** covering differential pressure range of 0.5 to 15 psi. for either gases or liquids at line pressures up to 100 psi., can be operated at carrier frequency of 60 to



10,000 cps. Device has natural frequency of 1,000 cps. for operating range of 1 psi. North American Instruments Inc., 2420 N. Lake Ave., Altadena, Calif.

Engineers Get New Plotters, Recorders

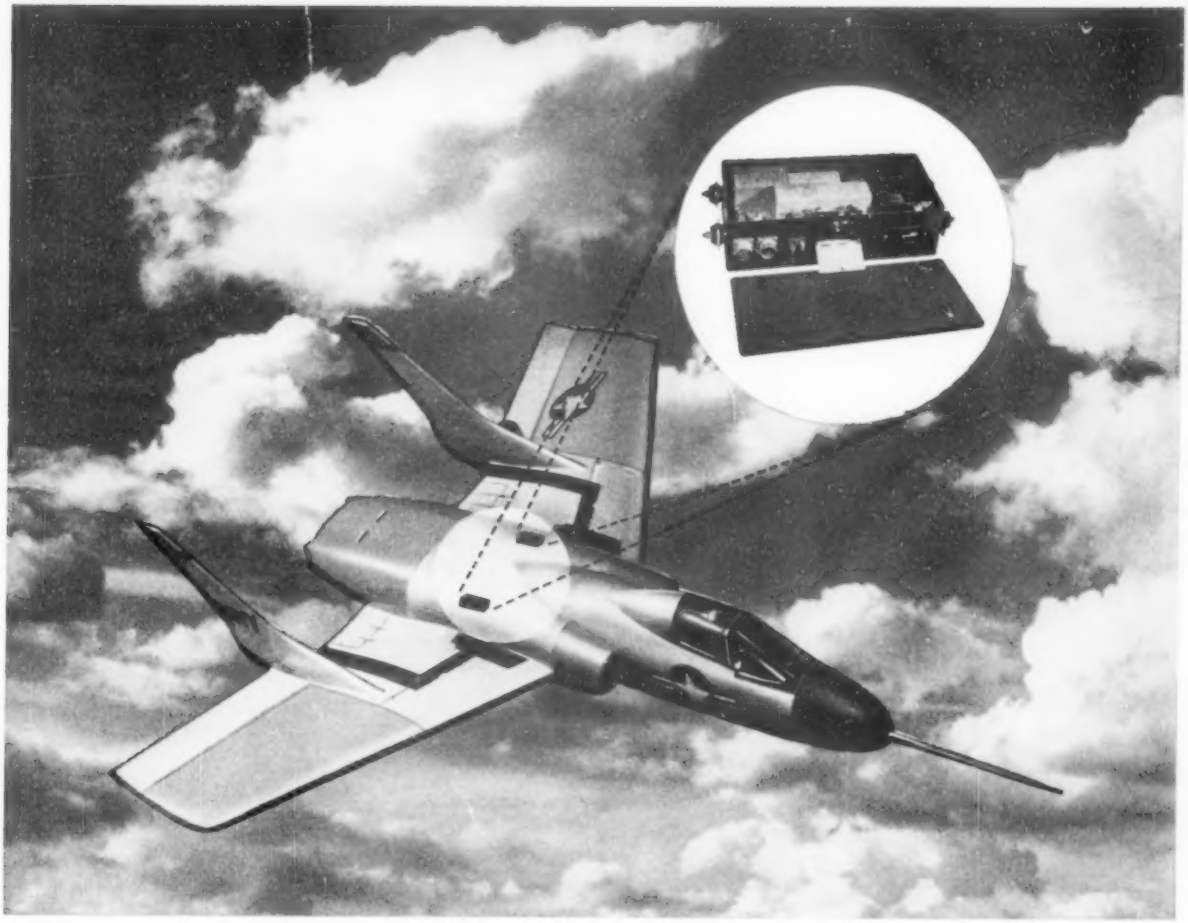
Several new recorders and plotters recently announced have application in lab and computer use. Details and manufacturers follow.

• **Dual function plotter** automatically measures two variables and plots their relationship to a third quantity which controls the speed of chart paper movement. Device operates from d.c. inputs. Manufacturer is Minneapolis-Honeywell Regulator Co., Industrial Div., Philadelphia, Pa.

• **Portable two-coordinate plotter** records either continuous curves or discrete point plotting, such as the output from a digital computer. Plotting surface is a 120-deg. concave cylinder capable of handling up to 11 x 16½-in. graph paper. Device provides for zero offset and continuously variable scale expansion of both axes over 10:1 range. Manufacturer is Librascope, Inc., 1607 Flower St., Glendale, Calif.

• **Recording milliammeter,** dual channel, drives recording pens through magnetic clutches to give device frequency response up to 15 cps., an accuracy of 5% through 6 cps., according to manufacturer. Recorder has four selective chart speeds, ranging from 12 in./min. to 12 in./hr., can record up to 100 hours on 6-in.-wide tape without reloading. Device weighs 15½ lb., comes in two models for operation from either 115 v., 60 cps. or 28 v./d.c. Manufacturer is Texas Instruments Inc., 6000 Lemmon Ave., Dallas 9, Tex.

• **Electroplotter** operates from a variety



TURBOJET ENGINE

TEMPERATURE CONTROL AMPLIFIERS

You want and must have completely reliable temperature control amplifiers — amplifiers designed and constructed to meet specific basic requirements of your turbojet engines, such as:

1. Efficient operation in ambient temperatures from minus 65°F to plus 200°F.
2. Vibration endurance covering a range from 5 to 150 cycles per second.
3. Operation in altitudes up to 60,000 feet through the use of hermetically-sealed components.
4. Center-of-gravity shock mounting to permit installation right on the turbojet engine.

Manning, Maxwell & Moore turbojet engine temperature control amplifiers satisfy all four requirements. They incorporate a highly successful design principle thoroughly proved during years of concentrated research, development and tests devoted exclusively to automatic control systems for jet engines.

We believe our ability to apply our unique design technique to specific and unusual turbojet engine temperature control problems can be of real value to you. Our engineering counsel and extensive manufacturing and test facilities are at your service. We welcome your inquiry.

MANNING, MAXWELL & MOORE, INC.

MANNING MAXWELL & MOORE INC. TRADE MARK

AIRCRAFT PRODUCTS DIVISION • STRATFORD, CONN. • DANBURY, CONN. • INGLEWOOD, CALIF.

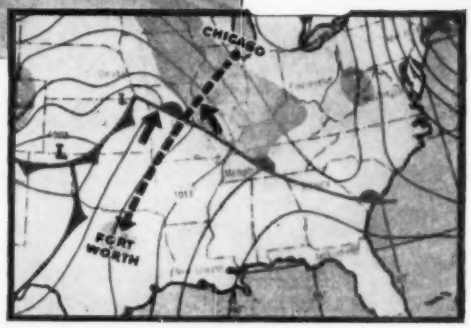
OUR AIRCRAFT PRODUCTS INCLUDE: TURBOJET ENGINE TEMPERATURE CONTROL AMPLIFIERS • ELECTRONIC AMPLIFIERS PRESSURE SWITCHES FOR ROCKETS, JET ENGINE AND AIRFRAME APPLICATIONS • PRESSURE GAUGES THERMOCOUPLES • HYDRAULIC VALVES • JET ENGINE AFTERBURNER CONTROL SYSTEMS.

FLY SAFELY

These weather items prepared in consultation with the United States Weather Bureau

In warm, fair weather surface winds may increase beyond safe limits in mid-afternoon. A safe wind at take-off may increase dangerously by the time you land. Watch for this.

Slight turbulence in clear air often signals a change in wind direction or velocity—check your drift and ground speed when you run through a patch of choppy air.



WIND MEASURING INSTRUMENT
COURTESY OF BENDIX-FRIEZ

Know the significance of "Gusts to 28," when reported. A gust is defined as a 10-mph increase in wind speed reaching at least 19 mph for not more than 20 seconds.

Expect a change in wind whenever you fly through an area of changing weather. Wind shifts are frequently associated with edges of rain or cloud areas.

Best Pair to Get You There

Mobilgas AIRCRAFT

Mobiloil AERO

FLYING SKILL and engine performance—you need both when rough weather blows in. That's why it pays to fly with top quality Mobilgas Aircraft and Mobiloil Aero. These famous aviation products assure smooth power and performance when you need them most.

Here's why: Flying Red Horse products are the result of the world's greatest lubrication experience... more than exceed rigid Army and Navy specifications... have the approval of every major aircraft builder. Why accept anything less?

SOCONY-VACUUM OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.

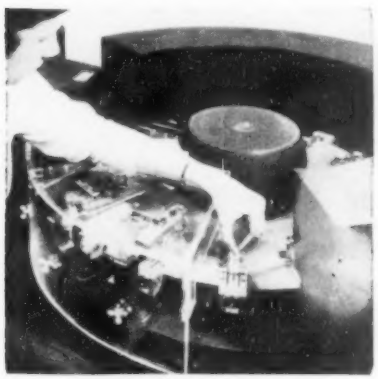
of input data such as catalog or digital computers, punch card machines or manual keyboard. Maximum plotting rate is 35 points/min., pen traversing speed is 18 in./sec. Device has independent zero and scale controls for each axis, selectable incremental advance when required, automatic symbol printing. Manufacturer is Benson-Lehner Corp., 2340 Sawtelle Blvd., West Los Angeles 64, Calif.

FILTER CENTER

▶ **Automation Analysis**—Assistant Secretary of Defense Newbury's office has prepared a report that recommends the weeding out of less promising programs for developing automatic factory techniques for electronic production. Report recommends the axe for USAF's project at Stanford Research Institute, but urges strong support for the Signal Corps program at General Electric.

▶ **Helicopter Simulator**—Link Aviation is considering development of a helicopter simulator. A novel requirement will be a visual ground reference for pilot, something which fixed-wing simulators lack, but which company officials say is essential for a helicopter training aid.

▶ **Transistor Bibliography**—"Guide To Transistor Literature" is the title of a handy new booklet prepared by Glenn L. Martin Co. The booklet lists more than 400 technical papers on transistors, the scientific or trade journal in which

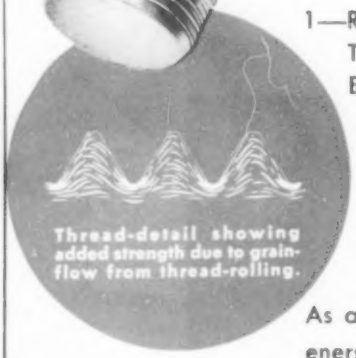


Capacitor Tester

Capacitors are automatically tested and sorted according to their individual variation from nominal capacitance in this device made by Industrial Instruments, Inc. Machine performs three high-voltage breakdown tests, automatically discharges units into reject bin if they fail to pass. Those that pass are tested and sorted according to their capacitance in up to eight tolerance ranges. Manufacturer's address is 89 Commerce Road, Cedar Grove, N. J.

THE NEW MS SERIES BY BRILES

Head section showing grain flow. Fillet rolled after heat treat for strength concentration.



Thread-detail showing added strength due to grain-flow from thread-rolling.

MIL-B-7838 SPECIFICATION FEATURES

1—Rolling Fillets and Threads After Heat Treat . . . (Increases Strength Through Elongated Grain Flow)

2—160,000 to 180,000 PSI to Withstand An Average of 65,000 Fatigue Cycles

3—100% Magnetic Inspection

As a pioneer producer of precision fasteners for the Aircraft industry exclusively, Briles specialized experience in cold heading and thread rolling gives the industry fasteners of the highest quality on a production basis.

BRILES MANUFACTURING COMPANY

COLD HEADED RIVETS AND BOLTS
3/32" to 1½" Dia.
EL SEGUNDO, CALIFORNIA

15 times longer life!

...for this TWIGG-BUILT turbine inlet casing

Sections of Type 310 stainless steel turbine inlet casing, formerly arc-welded, are now NICRO-BRAZED.* This latest atmospheric-controlled brazing process gives the assembly *15 times the service life* formerly experienced.

Nicro-Brazing is typical of the advanced metal-working techniques employed by TWIGG in fabricating *stronger, lighter, precision-built* assemblies to meet exacting performance requirements.

MANUFACTURING FOR AIRCRAFT:
combustion chambers, transition liners, turbine casings, tail cones, afterburners, burner supports, brackets, and other components.

TWIGG CAN DO IT...*for you!*

Whatever your product requires . . . precision fabrication, lightness with strength, heat or corrosion resistance . . . call on Twigg! Write for colorful new brochure, "Twigg Can Do It," illustrating our complete facilities for fabricating and machining stainless steel, aluminum, titanium and other high capacity metals.

TWIGG INDUSTRIES, INC.

DEPT. A-12, BRAZIL, INDIANA

they appeared, and date of publication. The guide is divided into sections on transistor theory, characteristics, circuits, applications, production and testing, and types. Detailed subject index is included. Booklet is available to industry engineers, Martin says.

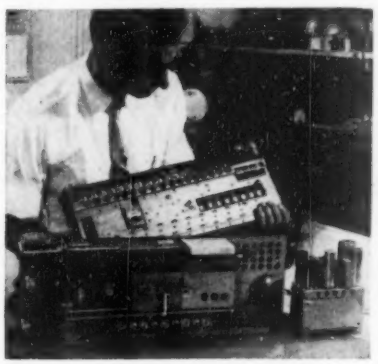
► **Receiver Conversion Kits**—Users of older military VHF and glide slope receivers (ARC T-11, 11A, 11B and R-89B) can increase their number of channels to 10 with kits developed by Aeronautical Electronics, Inc. The VHF kit adaptor plugs into existing crystal sockets, requires only two minor wiring changes. Glide slope adaptor requires slightly more work. Company will perform receiver modifications, if desired. Address is Raleigh-Durham Airport, Raleigh, N. C.

► **Expanding Industry**—Recent evidence of avionics industry growth include:

• **New company:** Insulated Circuits, Inc., formed to manufacture printed circuits and complete sub-assemblies, headed by Robert A. Curran. Address is 115 Roosevelt Ave., Belleville, N. J.

• **Name change:** Micromax Co. has changed its name to Computer Instruments Co., to better describe its expanding activities in field of computer and servomechanism components.

• **New office:** Pacific Division, Bendix Aviation Corp., has appointed C. E. Ruckstuhl as full-time East Coast sales representative for its telemetering and other avionic products. Office is at 475 Fifth Ave., New York, N. Y. —PK

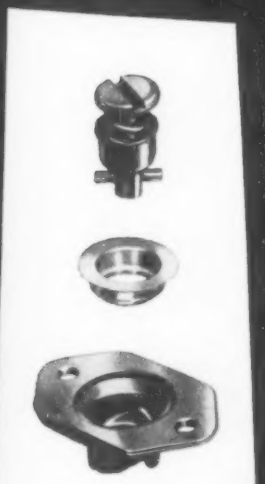


Easy to Maintain

Unitized construction is used in the new Narco airborne DME, with all five major sub-assemblies built on plug-in chassis for quick removal and easy maintenance. Two of these, the search and range unit (held, in photo) and power supply (right) are shown removed. Narco says that DME service centers which it has set up across the country will be equipped with DME simulators and replacement sub-assemblies, to facilitate test and repair. The 33-lb. Narco DME, currently in production, uses crystal control, is mounted in a ½ ATR rack.

DESIGNED FOR
ACCESSIBILITY

SIKORSKY S-56 HELICOPTER



In and out of trouble spots fast! This Sikorsky S-56 helicopter transports two Marine combat assault squads—at speeds in excess of 150 miles per hour. For quick accessibility to the 'copter's power plants, large panels on the twin engine nacelles are securely held by Camloc quarter-turn fasteners.

Another outstanding aircraft ...another outstanding fastening job by Camloc!

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FASTENER CORPORATION
22 Spring Valley Road, Paramus, N. J.
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Amazing
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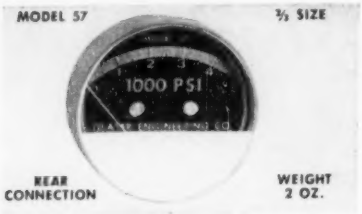

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● One of the major reasons for the tired feeling after a flight, even at altitudes under 10,000 feet, is oxygen starvation, or flight fatigue. You can take advantage of more economical higher altitudes, modern navigation techniques and reduce flight fatigue by installing a Scott fixed oxygen system in your ship.

SIMPLEST one positive control . . . accommodates up to 50 people.

LIGHTEST "per hour" of oxygen carried, plus smoke and fume protection for crew.

LOWEST COST — For example, the #8500 system for Twin-Beech installation costs approximately $390.

Write today for installation diagrams on your aircraft!

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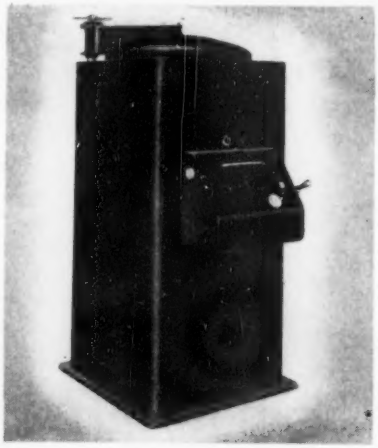
NEW AVIATION PRODUCTS



Accelerometer Tester Gives 850G Forces

A G-accelerator which can test accelerometers and other instruments to 850G under altitude and thermal conditions is offered by Genisco, Inc.

Range of this Model D accelerator is said to be infinitely variable from 20 to 1,750 rpm., with radius of gyration variable from 5-in. to 12-in. It is mounted on a circular table 24 in. in diameter with 108 ¼-20 tapped mounting holes balanced to equalize the weight of electrical leads.

Full capacity of the table is 1,000G-pounds. Up to six identical objects can be tested simultaneously if arranged symmetrically on the table.

The table can be braked to a full stop from maximum speed in approximately 10 seconds, Genisco notes. Drive mechanism is a 1-hp. 220-v., 60-cycle, three-phase motor and an infinitely variable Vickers hydraulic transmission with a ¾-hp. output.

Overall size of the machine is 63 in. high, 31½ in. wide and 42 in. deep.

Genisco, Inc., 2233 Federal Ave., Los Angeles 64, Calif.

Counting Device Checks Quality Control Work

A portable counting instrument that keeps a record of "accepts" and "rejects" is offered by American Hydromath Corp. as an aid to quality control.

The inspector presses either the "accept" or "reject" button at the base of the instrument as he examines each unit. His action actuates two counters —one showing subtotal for the shift, hour, or spotcheck period, the other showing total for the day, week or whatever longer period is desired. The counters are easy to reset.

By comparing current defective rate with allowable defective rate it is possible to determine when a production process is going "out of control."

Known as QualiCount, the device is self-contained, operates from 115-v. single-phase current. It may be connected to remote actuation means such as knee, foot or conveyor line switches.

American Hydromath Corp., 25-20 43rd Ave., Long Island City 1, N. Y.

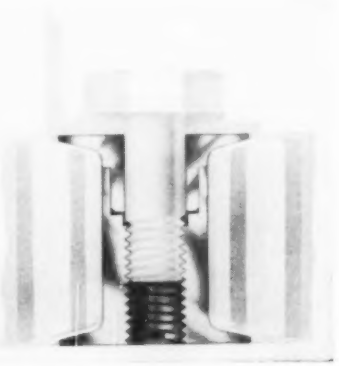
Left and Right Side Holes Drilled in One Operation

Simultaneous drilling of both right and left-hand parts is accomplished with a new drilling machine being put on the market by the Govro Nelson Co.

Equipment incorporates four automatic drilling units. Tap drills two ¼-20 holes in one operation at a rate of approximately 600 parts per hour.

For drilling, operator loads one each of right- and left-hand parts, presses the start cycle buttons and units are automatically clamped, drilled, unclamped and ejected.

Govro-Nelson Co., Detroit, Mich.



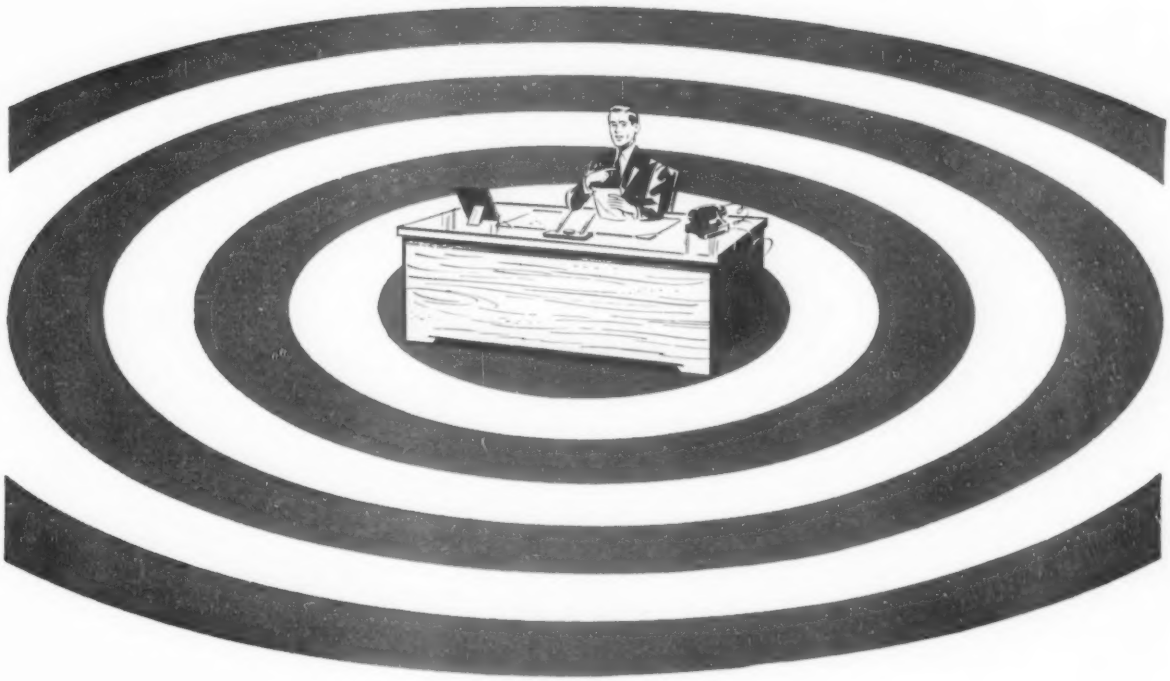
Threaded Spacer Made For Sandwich Structures

A threaded spacer with tapped sleeve that receives the attaching bolt and eliminates need for a nut is being made by Delron Co., Inc. The threaded spacer has been developed especially for light-load applications where weight-saving is a primary requirement.

The threaded spacer permits attachment of conduits, cables, instruments and other equipment to sandwich-type structures without danger of crushing the panels, the manufacturer says. Other uses include soft woods, such as balsa, and fragile structures where fastening takeup must be limited to a specified grip length.

Tradenamed Fasco, the units are

You a target?



Let's face it . . . we're all targets!

If your plant is not ready with a disaster plan, better act now. There's not a single American plant that's out of range of an intercontinental bomber—and fires, floods, tornadoes or explosions can kill you just as dead as an atom bomb.

It costs next to nothing to take a few simple steps which may save hundreds of lives. Here they are. Check them off today.

☐ **Call your local** Civil Defense Director. He'll help you set up a plan for your offices and plant—a plan that's safer, because it's integrated with community Civil Defense action.

☐ **Check contents** and locations of first-aid kits. Be sure they're adequate and up to date. Here, again, your CD Director can help. He'll advise you on supplies needed for injuries due to blast, radiation, etc.

☐ **Encourage personnel** to attend Red Cross First-Aid Training Courses. They may save your life.

☐ **Encourage your staff** and your community to have their homes prepared. Run ads in your plant paper, in local newspapers, over TV and radio, on bulletin boards. Your CD Director can show you ads that you can sponsor locally. Set the standard of preparedness in your plant city. There's no better way of building prestige and good community relations—and no greater way of helping America.

Act now . . . check off these four simple points . . . lives are at stake . . . have you a right to delay?

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HYDRAULIC EQUIPMENT

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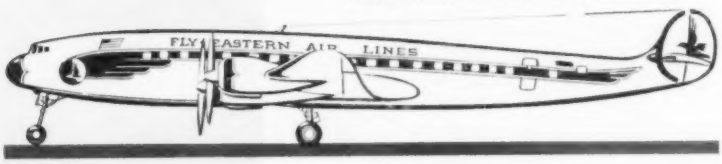
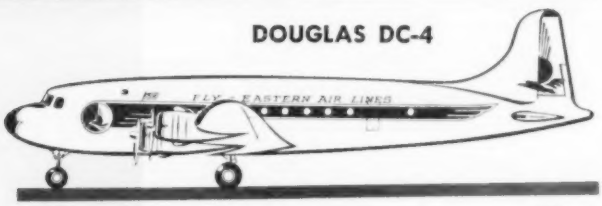


CONSTELLATION 749A

DOUGLAS DC-4



MARTIN SILVER FALCON

Eastern Air Lines (in common with most of the world's airlines) derives multiple advantages from the use of Vickers Hydraulics. First, it has the best aircraft hydraulic equipment available. Second, it obtains the many benefits of standardization. Third, it has the undivided responsibility of a single source.

Vickers Hydraulic Equipment has proved by hundreds of thousands of hours in the air its claims of longer life, greater dependability, better performance and lower maintenance.

The interchangeability resulting from standardization means a smaller and more flexible inventory of spare parts. It minimizes the number of test and inspection fixtures. It makes for quicker and easier training of maintenance personnel through the need for familiarization with fewer products.

Write for Bulletin A5200-B describing the complete line of Vickers Hydraulic Equipment for Aircraft.

6641

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ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

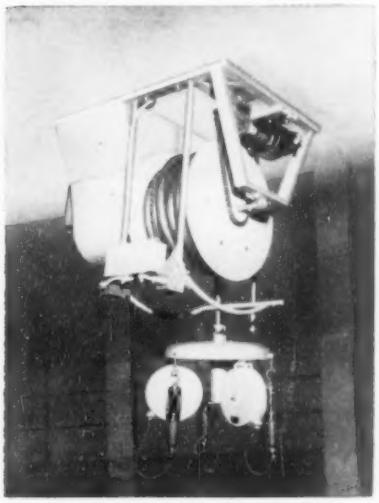
available with sleeves tapped #6-32, #8-32, #10-32 and ¼-28. Grip lengths are from ⅜ in. to 1¼ in. Spacers are made of 24 ST-3 aluminum alloy, anodized. No special tools are needed.

Delron Co., Inc., Fasco Div., 5224 Southern Ave., South Gate, Calif.

ALSO ON THE MARKET

All-purpose welding and brazing unit, known as Andco Uni-Flux, provides one flux for all types of gas welding and brazing, welds through lead, beryllium, aluminum, bronze, galvanized, copper, rust, grease, paint, tar and dirt, its maker claims. Unit also brazes and welds cast iron, chrome metals, stainless, Monel, aluminum, bronze and silver solder. Unit eliminates foreign substance from metal surface, eliminates crystallizing and cleans as it is used.—Andco, Inc., 235 Thorne Ave., Orchard Park, N. Y.

Ceiling-mounted power supply reel is used in hangars to facilitate repair and servicing of planes. Power fixture is lowered by pushbutton control to any part of plane within range of its 40-ft. cable. Power to charge batteries, etc.,



is transmitted through a 4-pole, 3-phase, 60-amp. plug. Three plug-in receptacles permit use of small power tools. Unit also has three explosion-proof work lights on reels. Model AT.—Reel-O-Matic Corp. of America, Columbia, Pa.

Profile template, 12-in. Adjusto model, uses brass strips .010 in. thick. Both a male and female profile are obtained in seconds on objects 12 in. long and 4 in. deep, the maker says. A right- and left-hand threaded member applies pressure on both ends simultaneously in order to obtain additional adjustment and locking force. Unit sells for $69.50.—Toolcraft Manufacturing Co., P. O. Box 507, East Chicago, Ind.

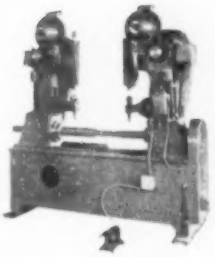
Save Labor . . . cut costs with

FASTER **Riveting and Clinching!**

T-J

RIVITORS

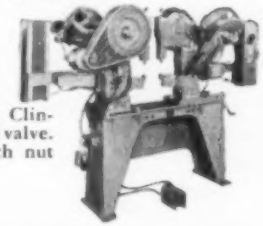
T-J RIVITOR used for automotive clutch plate assembly. Saves time and labor doing a four-fold job—assembling, setting, inspecting and ejecting.



DOUBLE RIVITOR sets two rivets at a time! Equipped with 10″ hoppers, and tooled to automatically feed and set two ¼″ dia. x ⅝″ long wagon box head rivets at a time in elevator chain and raddle or elevator flight assemblies for farm implements. Controlled by one foot pedal.

CLINCHORS

T-J CLINCHOR . . . one of six special 8″ throat Underfeed Clinchors used by a large automotive body manufacturer. Feeds and sets 11/16″ square cased nuts in outside quarter panels, left and right hand.



DOUBLE CLINCHOR sets two nuts at once! Tooled to feed and set ⅜″ x ½″ x 1/16″ thick Fabri-Steel nuts at each operation. Both Clinchors tripped by same foot-operated valve. Adaptable to wide range of clinch nut setting problems.

Automatic Feeding and Setting!

T-J meets your needs for labor saving SPEED in assembly . . . with performance-proved Rivitors and Clinchors for many jobs today . . . in aircraft, automotive, farm machinery, stampings of all kinds.

T-J CLINCHORS set clinch nuts 3 to 5 times faster! Fully automatic . . . controlled by a single foot pedal! Available in Underfeed and Gravity feed models, throat depths 8″ to 36″.

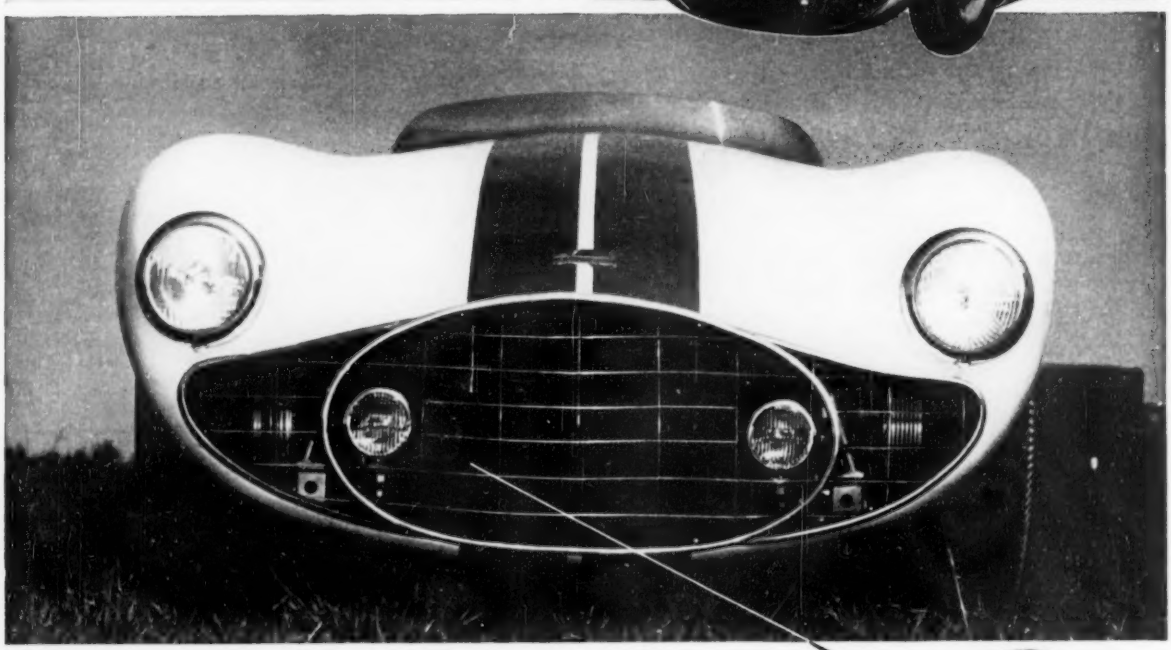
T-J RIVITORS automatically feed and set solid rivets . . . with high production! Electrically powered Rivitor sets 1/16″ to ¼″ diam. solid steel rivets up to ⅞″ long. Air-powered Rivitor sets aluminum alloy rivets up to ¼″ diam. or steel rivets up to ⅛″ diam. and up to ¾″ long. Throat depths 8″ to 36″.

Write for Clinchor bulletin 847; Rivitor bulletins 646 and 847. The Tomkins-Johnson Co., Jackson, Mich.

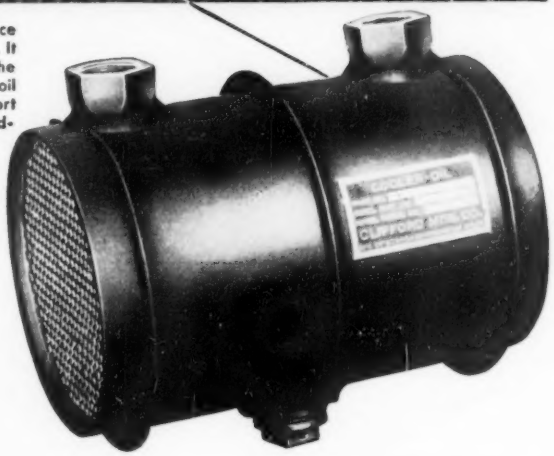
37 YEARS EXPERIENCE T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS



THIS LATEST CUNNINGHAM SPORTS CAR won its class and placed 3rd on distance in the grueling International 24-hour road race at Le Mans, France, in June, 1953. It *absolutely* cannot operate without an effective, lightweight oil cooling system — the engine bearings would burn out in less than one hour! That's why a Clifford 6" circular oil cooler, seen beside the right front brake drum, is essential. Cunningham engineers report it kept the oil cool during the entire 24 hours of racing — 2498.23 miles of road-pounding torture above 100 MPH average speed.



At any altitude... Clifford oil coolers are vital

In the air as on the ground, Clifford Feather Weight All-Aluminum Oil Coolers bring exceptional benefits to the protection of engine lubricating systems. For one thing, they're *the only all-brazed type of oil cooler*. Another big advantage is their superior weight-strength ratio — the result of Clifford's patented aluminum brazing method and pre-testing in the largest, most modern wind tunnel laboratory in the aeronautical heat exchanger industry. You'll find Clifford Feather Weights in every type of modern aircraft, military or civilian, jet or piston powered. For further details, write Clifford Manufacturing Company, 136 Grove St., Waltham 54, Mass. *Division of Standard-Thomson Corporation*. Sales offices in New York 17, Detroit, Chicago 1, Los Angeles.

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CLIFFORD HEAT EXCHANGERS
... CUSTOM ENGINEERED
FOR MORE EFFICIENT HEAT TRANSFER

Aircraft Dividend Record and Yield

(Cash Payments Only)

Company	Calendar Years 1950	1951	1952	1953	Approximate Indicated Yield*
Beech	$0.80	$0.80	$1.05	$0.50	nil
Bell	0.88	1.13	1.50	2.00	7.7%
Boeing	2.00	2.00	2.67	3.50	5.5
Cessna	0.20	0.40	0.50	0.50	6.2
Convair	1.00[2]	1.40	1.75[2]	1.80	7.8
Curtiss-Wright	1.00	1.00	0.60	0.60	6.7
Douglas	3.13	3.50	3.75	6.50	5.9
Fairchild	0.60	0.40	0.60	0.80	7.3
Grumman	2.00	2.00	2.00	2.00	7.8
Lockheed	1.50	1.10	1.20[1]	1.88[1]	5.9
Martin	None	None	None	None	nil
McDonnell	1.00	1.00	1.00	1.00	4.5
North American	1.25	1.25	1.50	1.50	7.4
Northrop	None	None	1.00[1]	1.00[1]	5.2
Republic	0.50	1.00	1.25[1]	1.50[1]	5.3
Ryan	0.20	0.40	0.50	0.50	3.8
United Aircraft	1.67	2.00	2.00	2.75	5.2

NOTE: Tabulated on a per common share basis. Adjusted for all stock splits.
(1) Plus stock dividends.
(2) Plus other assets distribution
* 1953 cash payments or 1954 rate if indicated on current market quotations.

Aircraft Dividends Continue Climb

All but one of 17 firms studied equaled or bettered 1952 payments last year; outlook for 1954 is good.

Sixteen of 17 leading aircraft firms again paid dividends in 1953, repeating performances of the previous three years. In only a few cases were dividends not as high as or higher than those paid to investors by the same firm in 1952

These facts are revealed in an exclusive AVIATION WEEK compilation, which shows a general trend to increased dividend disbursements by the aircraft group.

Glenn L. Martin Co. remained the only aircraft firm failing to pay any dividends during 1953, making it six consecutive years of no payments to stockholders.

▶**Tax Relief**—Beech Aircraft Corp passed the last two quarterly disbursements of 25 cents each as the result of complications growing from cancelation of a major military contract. However, management has declared its intention of restoring past dividends as soon as it can.

As the result of a congressional proposal to afford partial relief from double taxation of dividend income and the past performance of these firms, the investment factor of aircraft and equities is expected to be enhanced.

While full details of the proposal now before Congress are too technical to warrant a full discussion, the import would be sufficient to encourage investors in all tax categories to seek out dividend-paying equities. And many aircraft equities for some time have afforded liberal dividend income yields. This fact has been indicated repeatedly here (Sept. 10, 1951, p. 60).

▶**Current Yields**—While dividend payments for the aircraft group have been well maintained, yields actually have declined recently. This has not made investors in aircraft unhappy. In fact, it has been a most pleasant phenomenon, reflecting as it does sharply higher market prices. About seven months ago, many of the aircraft stocks at the then prevailing market quotations showed an income yield ranging from 7% to approximately 10% with the predominance appearing in the upper registers (AVIATION WEEK July 27, 1953, p. 65).

Current yields, as indicated by the accompanying table, show an indicated cash income ranging from about 4% to around 8%, with thee average around 5.5%.

At current market quotations, and based on the 1953 dividend rates, income yields of 7% or better remain indicated for Bell, Convair, Fairchild and Grumman.

North American Aviation's current yield of 7.4% is based on 1954 indications as the company went on a quarterly basis of 50 cents a share early this year. This indicates a $2 annual rate as compared with $1.50 paid in

ENDS WHIP AND VIBRATION

TAPER SHANK SPIRAL BITS

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Extensively used for routing non-ferrous metals in Aircraft production. Special alloy high speed steel, precision formed and ground. For use in Onsrud Patented Inverter Taper Chuck in all A series Radial Arm Routers. Taper fit assures perfect axial alignment, eliminates "whip" and vibration. MAIL COUPON *for Bulletin* or Order Special Trial Assortment.

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"I know all factory recommended modifications are incorporated."

Says *Leonard Lee*

Chief of Maintenance—Continental Can Co., Inc.

"Those modifications make my engine safer, more reliable and less costly to operate. For instance, 98 different modifications must be applied during overhaul to modernize the R-1830. If any of these are skipped, my engine isn't as up-to-date as it should be. And most modifications are inside—where I can't check them!

"That's why I stick to Airwork for overhauls. They are *completely* dependable."

Mr. Lee has supervised maintenance of Continental Can Company's business fleet for 9 years. Last year they flew 3,000 hours—more than 657,000 miles. Mr. Lee was formerly in charge of Convair's Flight Engineer School.

Airwork CORPORATION
Millville, New Jersey
NEW YORK MIAMI WASHINGTON

PSP AIRCRAFT QUALITY SOLENOIDS

D. C. Solenoids for use with instruments, valves and aircraft remote controlled equipment •220 standard models •Push-type, Pull-type and Combination • Continuous or intermittent duty • Single and double coil • For operation at ambient temperatures to 500°F. Electrical connectors and mounting brackets for most requirements.

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Largest Manufacturer on the Pacific Coast Producing Aircraft Quality Solenoids Exclusively

1953 in two 75-cent semi-annual distributions.

▶ **Best to Come**—Sustained production, sales, earnings—and dividends—have, for the most part, been a strong character for the aircraft group and attracted considerable investment support. Reports released thus far for 1953 make excellent reading with predominant implications that the "best is yet to come" in 1954.

The fact that important segments of the aircraft industry have demonstrated sustained dividend payments extending over a considerable period of years has done much to introduce a measure of confidence among investors. Among the aircraft enterprises having a string of consecutive dividend payments (with varying annual amounts) for 10 years or more: Bell, Boeing, Cessna, Curtiss-Wright, Douglas, Garrett, Grumman, Ryan and United Aircraft.

The contrast between current dividend payments for some companies and the market price of their equity at their early stages of development is indeed phenomenal. For example, Garrett Corp., a manufacturer of specialty aircraft equipment, reveals an interesting record of substantial growth and success to its early supporters. Back in 1941, it would have been possible to buy Garrett Corp. stock at the equivalent of $2 per share.

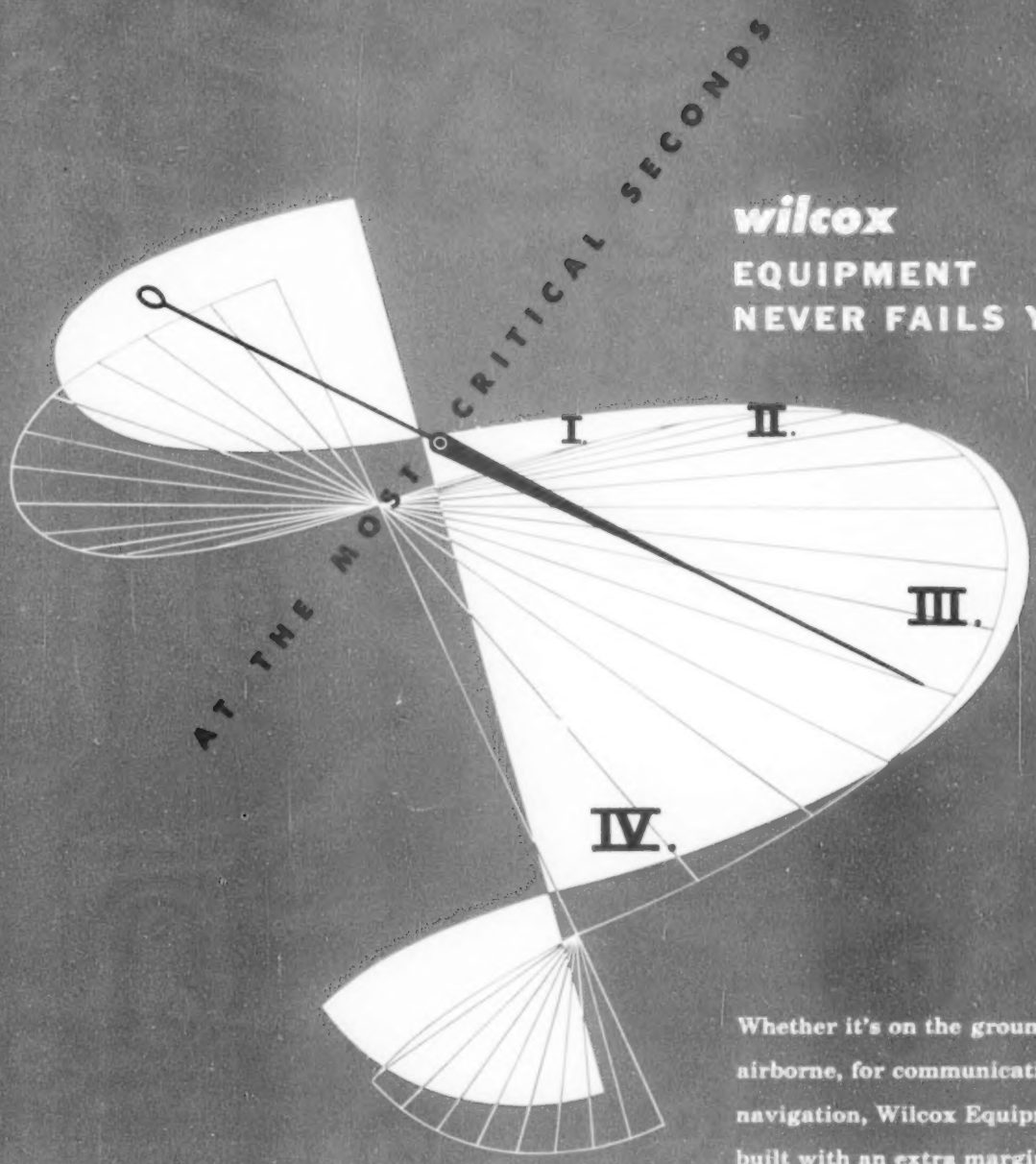
Cash dividends were started in 1942 and amounted to 30 cents per share, as adjusted on the present capitalization. Since that time, about $10 per share on the existing stock has been paid in cash disbursements. Current market quotations of $26 per share are more than 13 times the price quotations of 1941.

The current annual dividend rate alone almost approximates the total purchase price of $2 per share of Garrett stock in 1941.

▶ **Risks, Results**—This success story demonstrates the outstanding results possible with a specialty filling a definite need and brought along by competent management in a growth industry. Getting it on the "ground floor" can return highly profitable results, but at the time such commitments are made substantial risks also are present.

For this reason, despite the strong inherent position of the aircraft industry as a whole, not all companies can be expected to show uniform results. The quality of management, ability to develop "articles" desired by military and commercial customers, and the capability of producing efficiently at profitable levels are among the more important elements dictating future operations for the separate companies. Selectivity among the various aircraft builders, always a dominant consideration, is now more important than at any time in the past.

—Selig Altschul



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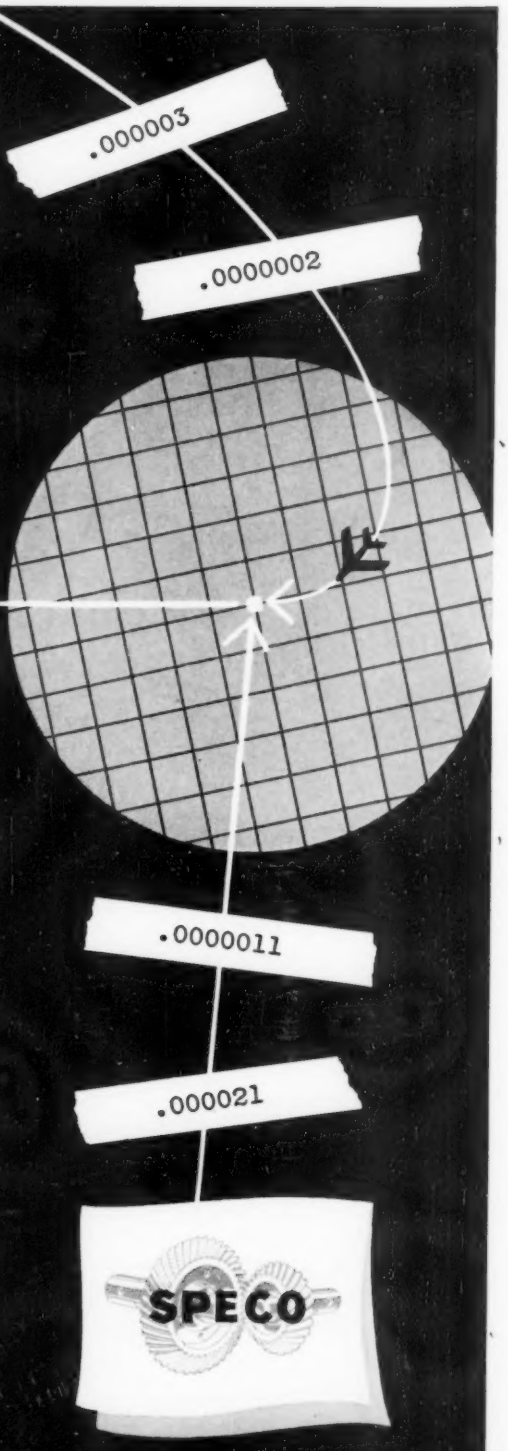

• We haven't yet found this on a drawing but... on a bombing or computing gunsight, an almost infinitesimal decimal error in the device itself, may well be multiplied to hundreds of yards, at the target area.

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Allegheny Offers New Mail Pay Formula

- **Flat mileage rate asked by feederline president.**
- **Present rate scale restricts development, he says.**

By Richard Balentine

Allegheny Airlines, oldest U. S. local service air carrier, has come up with a proposal that may help solve one of the basic problems of the subsidy-bound feederline industry.

Leslie O. Barnes, Allegheny's 37-year-old president, asks Civil Aeronautics Board hereafter to determine the company's pay on a flat mileage basis instead of the current sliding-scale formula used for local service airlines.

"We are not seeking any more mail pay than that forecast by CAB," he says. "We are asking revision of the formula which tends to limit the operation of developmental and experimental service."

▶ **Planning Advantage**—"Such services are a basic responsibility under the local air service program and should not be subject to restrictions beyond forecast mail pay requirements," Barnes suggests. "Under the present formula, the company has little alternative but to reduce developmental services to a minimum."

Barnes says the "flat mileage rate would place the responsibility for the operation of additional services on management rather than a formula and would permit more intelligent planning of future operations."

Allegheny's current mail rate was designed to yield a profit of approximately $116,000 in 1953. Actually the company's profit was only $3,754 due to developmental scheduled operations and the practical effect of the mail pay formula, the airline president points out.

Put on a flat mileage rate, says Barnes, "Allegheny could develop more representative profits and, at the same time, provide substantially increased services at no additional cost to the government."

▶ **Significant Proposal**—Barnes proposes a measure that is sure to stir the local service transport industry. He told AVIATION WEEK it would be one way to stop the major part of the feederline industry from returning to the Board for additional mail pay.

"There is an element in the mail rate formula whereby mail payments are progressively reduced for each mile operated beyond the base specified in the mail rate order," he says.

DC-3 REPLACEMENT, cheaper to operate and with more seats, is needed, says Barnes.

"Projected far enough, this element dictates a load factor unattainable with DC-3-type aircraft. When this element is combined with the certification of relatively unproductive additional route miles, adjustments in the mail rate are required," he said.

▶ **DC-3 Airline**—Allegheny, like other local services lines, is a DC-3 airline, owning a fleet of 13. Unlike the others, however, Allegheny has not been plagued with unproductive mileage in addition to the base stipulated in its mail rates. It flew more than 250,000 mi. of developmental routes during 1953 at no cost to the federal government.

LESLIE O. BARNES: Revise the formula.

If the difference is too great between the base mileage specified in the mail rate and that required to render adequate service over the routes, then adjustments in the rate are required, Barnes contended.

▶ **Three Factors**—"As we understand it," he says, "permanent mail rates of the local service carriers contain three elements having a direct bearing on mail pay requirements. These are: base mileage, load factor and mileage in excess of base mileage.

"As the mileage operated exceeds the base mileage stipulated in the mail rate, progressive reductions are made in mail payments. It is presumed that this is a safeguard against a carrier operating excessive or unproductive mileage. In actual practice, the third element in the formula acts as a penalty for each mile operated beyond the base miles."

Allegheny's president does not suggest that the basic mileage for which mail pay is received should be increased coincident with an increase in certificate route mileage. He recommends one of two alternatives:

- Mileage penalty provision should be completely eliminated from the formula on these grounds: Adequate safeguards already exist against excessive mileage; it tends to stifle or retard development of nonmail revenues in an airline's area; it forces a carrier into

mail rate hearings that otherwise would be unnecessary and, at the same time, increases the work load of the Board.

• As the need is shown for additional mileage as evidenced by a high load factor or as additional mileage is certificated to a carrier, the point at which penalties normally commence to accrue automatically should be extended beyond the base to an extent consistent with the requirement.

▶ **Trunk-Feeder Mergers?**—The day is coming, "probably within the next five years," Barnes says, when air transportation will be divided between the trunk and local service airlines.

"Smaller trunk carriers," he predicts, "will be absorbed through mergers or consolidations with the major trunk carriers. Ten trunk carriers probably will remain.

"At the same time, the nation will be divided into seven and possibly as many as 10 regions served by a single local service carrier in each region. In this way substantial economies may be made in the reduction of indirect operating costs of the local service carriers."

Although this must be approved by the Board, the primary initiative, says Barnes, "must emanate from the local service carriers." In this way airmail subsidy requirements (now $25 million annually) will be reduced, he claims.

▶ **DC-3 Replacement**—Complete elimination of subsidy requirements, he says, necessarily must await the use of new or more productive equipment.

Absence of a suitable replacement for the DC-3 now is a "major stumbling block to truly significant progress," Barnes points out. "On some segments of Allegheny Airlines, the inability to provide more seats unquestionably has had an adverse or discouraging effect on public acceptance of local service in our area."

Although the DC-3 has been the local service airline's workhorse, it is now getting too expensive to operate, the Allegheny chief executive warns. It now costs Allegheny 2¼ cents a seat mile to operate the airplane. Because the surplus parts market for DC-3s is drying up, he reports it may go to 2½ cents soon.

"As long as we operate the DC-3," said Barnes, "we will never be without subsidy."

▶ **Foreign Market?**—He says the Convair 340 and the Martin 2-0-2 are not local service airline transports because they are too expensive to operate. Helicopters still are five to 10 years off for Allegheny's purposes, Barnes adds, and four-engine equipment—such as the DC-4—require bigger and more substantial fields than many of the airports the feederlines serve.

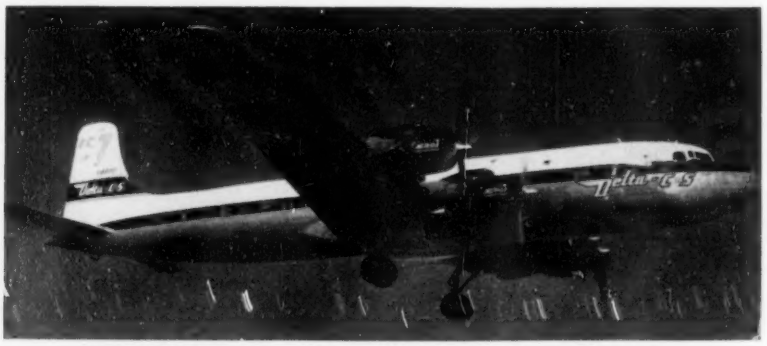
Only immediate solution may be in the foreign market, where several DC-3 replacements are being built, he says.

▶ **Restrictions**—Another force depriving local service airlines of their quicker development, Barnes says, is the "restrictions placed on local service schedules between terminals and intermediate points where such restrictions have been established for the protection of the trunk carriers should be removed."

He points out that the feederlines have turned over roughly $20 million in business to trunk airlines thus far.

▶ **Confident of Future**—On the occasion of Allegheny's fifth year of scheduled passenger service last month, veteran aviation executive Barnes voiced optimism in the future of the local service business:

"The growth of Allegheny during the last five years is a testimonial to the cooperative efforts of the communities served and the employes of the company. On the basis of current trends, Allegheny will achieve an even greater record during the next five years."



DC-7 Uses Landing Gear as Speed Brake

Delta-C&S Air Lines' Douglas DC-7 demonstrates how this transport can extend its landing gear to slow its speed if unexpected turbulence is encountered or to maintain optimum flight altitude before letting down at destination. The landing gear and doors are stressed to permit extension at 300 mph. below 15,000 ft. (285 true indicated airspeed at 25,000 ft.) and more than double the plane's drag when they are opened. With these speed brakes down, the DC-7 can descend at 4,500 feet per minute.

Ryan Offers Solution To Feederline Profits

Civil Aeronautics Board member Oswald Ryan says profits of local service airlines might improve if they received higher interline compensation for the cost of originating traffic that will transfer to long-haul carriers.

This originating cost is not duplicated by other airlines that carry the passenger, he points out.

"It is the present practice in the case of a local service carrier which originates a long-haul, interline passenger to allocate the passenger's fare on the basis of mileage," Ryan adds.

▶ **Increased Revenues**—Management of the local service lines has been good "with very few exceptions," he reported in a speech at Purdue University.

They have increased steadily their commercial revenues and until 1951 were successful in accomplishing a progressive reduction in their unit operating costs, the Board member reports.

"But the greater increase in operating expenses which has confronted these carriers since 1951," says Ryan, "has more than absorbed the steady increase in revenues which they were able to accomplish."

He says two factors create this condition:

• **Substantial expansion** in the volume of their operations, resulting from new routes added to local service systems and new frequencies added to operations.

• **Increase in labor** and materials costs, including the price of gasoline and similar items.

"There would be no problem in the equitable distribution of the passenger origination cost in the case of such interline traffic if all participating carriers transported the passengers approximately the same distance," Ryan says.

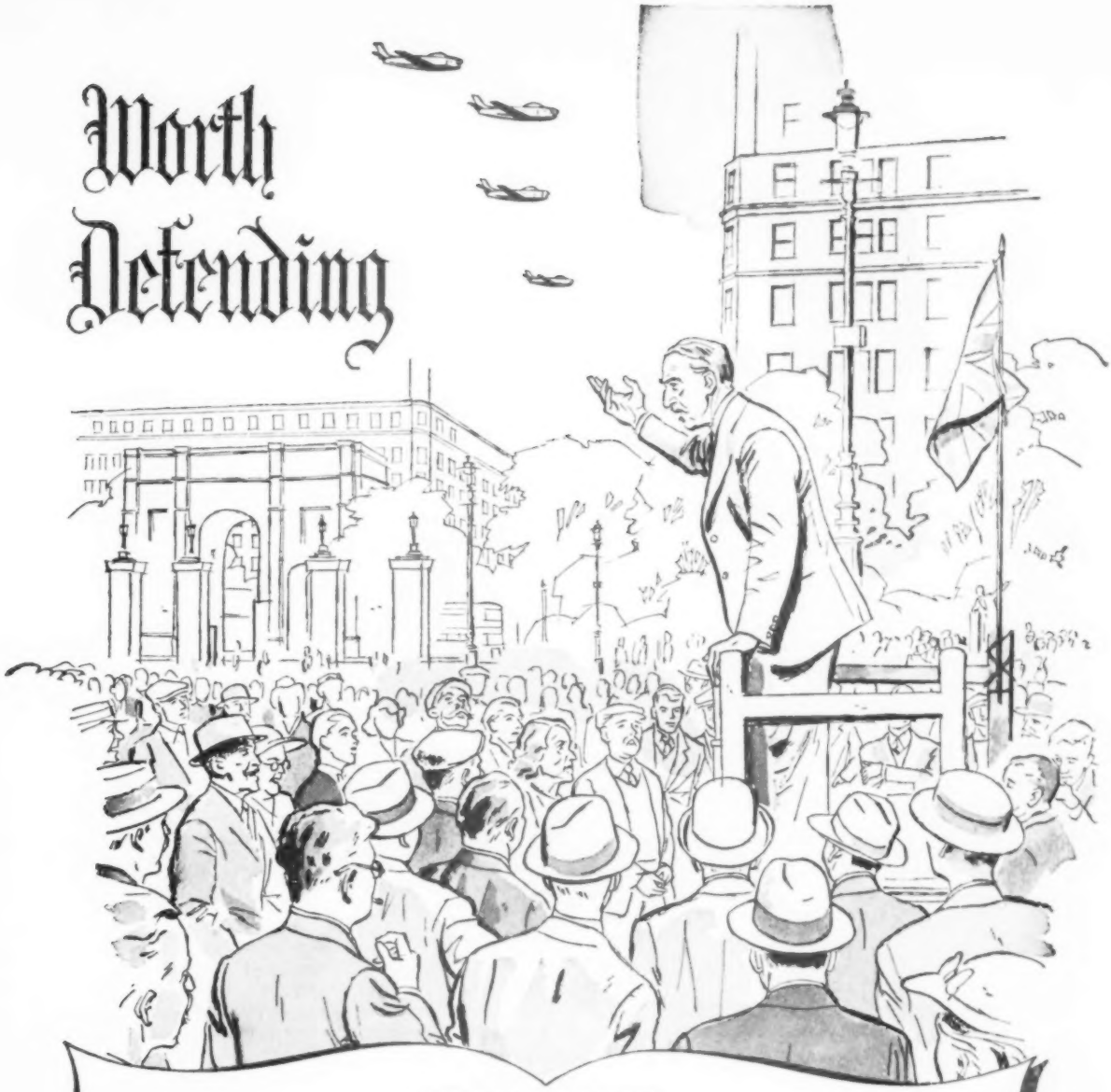
"Under these circumstances, the extra-cost burden from on-line passengers going to other carriers would be approximately balanced by the cost savings from off-line passengers originated by other carriers."

Long Beach Opens Passenger Heliport

Long Beach, Calif.—First passenger heliport in Southern California has been dedicated here with the opening of the new Long Beach Municipal Heliport.

The heliport will be one of the first terminals for Los Angeles Airways when the airline begins passenger service later this year. Meanwhile, it will be used for mail and express service.

Worth Defending



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"I disapprove of what you say, but I will defend to the death your right to say it!"
— VOLTAIRE

Freedom of Speech — the right to champion one's political views . . . to protest acts of government . . . to express new ideas or defend old ways . . . these become "crimes" and are hastily silenced wherever fascism or communism reigns . . . and liberty of thought and conscience is no more.

Consider the liberty which we, in the free nations, enjoy . . . to speak out against wrongs . . . to speak up for what is right! Our Freedom of Speech is the great keystone of true democracy. Our Freedom of Speech is *worth defending!*

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COMBINATION-CLASS Stratocruiser has first-class aft, tourist-class in forward section.

STATEROOMS on trans-Atlantic routes feature reclining lounge chairs and full couches.

PAA's New Double-Duty 377s

Pan American World Airways has introduced two major modifications on portions of its Boeing Stratocruiser fleet to provide:

- Combination first-class and aircoach facilities aboard the same aircraft on a number of the airline's Pacific routes (AVIATION WEEK Mar. 22, p. 68).
- Luxury staterooms for first-class flights on trans-Atlantic routes.

►**Quick Conversion**—In the combination first-class-tourist configuration, PAA has made two separate sections through use of a sturdy partition between the aft and forward portion of the plane. By changing the position of this partition and altering the seat ratio, it is possible to convert the aircraft quickly to four different seating arrangements to meet any fluctuations in travel trends.

Aft portion is reserved for first-class passengers, while the forward section is occupied by tourist fares. First-class passengers have separate dressing room facilities, a 66-lb. baggage allowance, exclusive use of the lower-deck lounge, meals with champagne and dinner wines and Sleeperette seats.

Tourist passengers received complimentary meals and a baggage allowance of 44 lb.

The seating conversion can be accomplished during the time aircraft is on the ground at stopovers along south and central Pacific routes, says PAA.

►**Staterooms**—The new staterooms on Atlantic routes will carry a surcharge of $125 and will be available for single occupancy when two first-class fares are paid.

MOVABLE partitions separate classes.

Features include a private washstand, mirror and completely stocked toilet article cabinet, wash basin with hot and cold water, and a side stand with a combination bar and bookshelf.

Fully reclining lounge chairs with large foot rests are provided, as well as a leather-covered divan, private clothes closet, large removable table and space for storage of overnight baggage.

Stateroom passengers have a choice of menus and may have meals served at any time during the flight. Special beverage service and additional snack service also are available. At departures and enroute stops they may board the plane ahead of other passengers.

TWA to Lease New $18-Million Base

Trans World Airlines has signed a lease with the city of Kansas City, Mo., for an $18-million overhaul base to be constructed at the city's new industrial airport site in Platte County, 16 mi. northwest of the municipal airport.

The entire base is scheduled for completion within two years, but TWA plans occupancy and use of the engine overhaul shops by September of next year.

►**Overhaul, Test**—Facilities will consist of three main buildings—main overhaul and office building, engine overhaul and warehouse structure, and a test cell building.

The main overhaul and office building will be the largest, measuring 816 by 420 ft., with a three-story office and shop section in the center. The two-level engine overhaul structure will run 435 by 90 ft., while the test cell facility will measure 80 by 212 ft. The latter will include six engine test cells, three control and accessory rooms and a cabin supercharger test room.

►**$217 per Acre**—According to TWA's agreement with the city, the company will rent 135 acres of the 4,700-acre airport at an annual ground rental rate

of $217 per acre, or $2,442 per month.

The airline also will pay the city $200 per month for full use of the airport, along with a monthly rental sufficient to amortize cost of construction and improvement of facilities over the 30-yr. period.

Landing fees will be required for both scheduled and nonscheduled flights, based on aircraft weight and number of landings.

The TWA-city agreement is contingent upon three conditions:

• **Completion** by Apr. 30 of a feasibility study (by an outside agency), which will outline economies the airline can expect to realize through an enlarged and more efficient overhaul base. Such a report is necessary before bonds can be sold.

• **Availability** of bond money, because construction will be financed by sale of revenue bonds.

• **Meeting** of construction completion and occupancy deadlines set down by TWA.

Postal Air Policies Up for Study

Senate committee to review entire airmail problem, including postage rates and carriage of first-class.

By Katherine Johnsen

Airlines have a big stake in the comprehensive re-evaluation of postal policies planned by the Senate's Post Office and Civil Service Committee in the near future.

One major issue to be considered is whether all non-local, first-class mail should move by air. Hearings are scheduled to start Apr. 19, with government witnesses.

▶ **Key Questions**—Other key issues the committee, headed by Sen. Frank Carlson, is aiming to solve:

• **Who should set postage rates**—Congress, as at present, or the Post Office Department? The congressional process is slow and has been widely blamed for the mounting postal deficits. Congress has been reluctant to boost postage rates to increase postal revenue.

• **What criteria should be used** in setting postage rates? Post Office now allocates its overhead among the various classes of service, and recommends postage rates sufficient to assure a balance between the revenue and expense of each class. But Post Office's allocations have been called unrealistic.

Airlines charge that the air service assumes far too great a portion of the overhead, and Post Office has used this to justify higher airmail postage rates.

• **Should Civil Aeronautics Board** or Post Office set rates paid air carriers for transporting mail? As a purchaser, Post Office wants a free hand to bid for the best rate it can get.

Airlines already are greatly concerned over the 18-20-cent rate the department bargained for on experimental routes for shipping three-cent surface mail by air on a "space available" basis over New York-Chicago-Washington routes. The fact is that all surface mail over these routes is going by air.

The mail volume from New York to Chicago is 90 tons daily. But the excess capacity of only two air carriers, United Air Lines and American Airlines, between these two points is 130 tons daily. The "priority" given the six-cent airmail letter has no meaning.

Airlines are fearful that when it becomes generally known that all three-cent mail is going by air, purchases of airmail stamps for shipments over these experimental routes will end.

• **If it is decided** that all non-local, first-class mail should go by air, should the postage rate be four or five cents an ounce? Airlines favor the five-cent rate. However, there is strong pressure on congressmen against eliminating the three-cent postage stamp and making available only a five-cent stamp.

Opinion on Capitol Hill inclines toward a four-cent rate. It is believed that citizens would go along with a four-cent rate for faster service. In addition, the Administration's plan is to boost the three-cent surface rate to four cents. Airlines, on the other hand, are apprehensive that low revenue under the four-cent rate might be used as a weapon to beat down rates paid carriers.

On Apr. 1, Canada set a precedent by inaugurating a program of dispatching all first-class, non-local mail by air at a five-cent rate.

• **If the two classes** of first-class mail—air and surface—are maintained, should airmail postage rate be boosted from six to seven cents? This is the Administration's proposal, already approved by a majority of the House Post Office and Civil Service Committee. It will be challenged on the House floor and faces stiff opposition in the Senate Post Office Committee.

• **Should helicopter airmail service** be continued? Post Office, which has testified that the service is too costly for its value, is expected flatly to recommend discontinuance.

▶ **Conflicting Reports**—The Senate committee has two lengthy and conflicting reports as a basis for its hearings on postal policy:

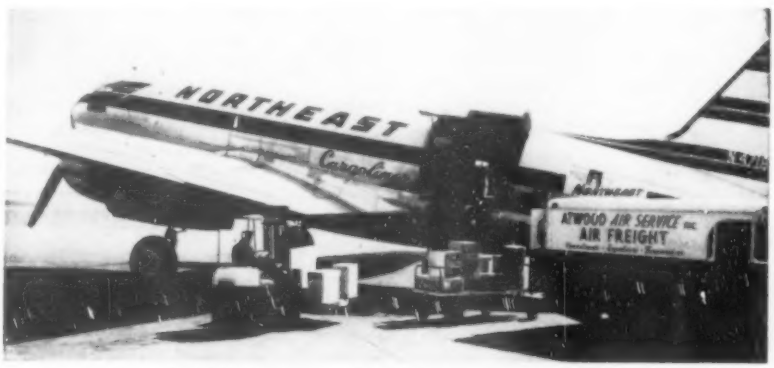
• **A 364-page report** by an advisory council established a year ago. The group included Robert Ramspeck, vice president of Eastern Air Lines.

• **A 350-page report** by the Post Office Department refuting most of the findings of the advisory council.

The advisory council's report presents Air Transport Assn.'s proposal for shipping all first-class mail by air and showing the airlines' ability to handle the volume (AVIATION WEEK Feb. 1, p. 67). The council made no recommendation on the proposal.

The Post Office report says shipment of surface mail by air "will be further extended if experience proves it practical," and adds:

"The purpose of the plan is not to provide air transportation as such, but to carry out a policy of utilizing such facilities where they would provide a more efficient and economical service than would be available through the



NEA Starts All-Cargo Flights

Northeast Airlines has started all-cargo service in the New England area, using a recently acquired C-46F that will take up to six tons of freight, the airline reports. The plane also will be used on special cargo charter flights that can be fitted into schedules. Presently, the transport is flying New York-Boston; Portland, Me.; Manchester, N. H., and Worcester, Mass. C-46 schedules are coordinated with other airlines flying out of New York and Boston. NEA inaugurated its C-46 freight service Apr. 1.

use of surface transportation exclusively."

▶**Bid Freedom**—The Post Office report repeats the department's request, made last year in testimony before the Senate Appropriations Committee, that it be free to bid with nonskeds or certificated freight carriers for mail transportation and permitted to ship at the most reasonable rate over routes on which scheduled airlines have different mail pay rates set by CAB. "The Post Office still does not have the privilege . . . to purchase the fastest and cheapest transportation," the department objects. "It can do a better job if it has that right. The Congress, by its investigational powers and the examinations of the General Accounting Office can prevent abuses." (Prior to the 1938 CAA Act, carriers were bidding for mail contracts below cost, simply to acquire operating rights.)

The department announced legislation is being drafted "which would make it possible for us to negotiate for lower rates with individual airlines."

▶**Opposite Views**—The advisory council supports the setting of postage rates by Congress. The Post Office wants authority "to initiate action to adjust postal rates whenever significant changes occur or are expected to occur in cost levels, with the objective that rate changes shall take place concurrently with such cost changes." It proposes a review by an independent commission, before the rate changes become effective, to ascertain that the action will be in conformity with principles laid down by Congress.

The advisory council concurs with the airline position that Post Office's cost ascertainment system largely is guess work and should not be referred to in determining postage rates.

A study made for the council by Price-Waterhouse and Co., an accounting firm, showed that simply by changing the allocation formula it could be demonstrated that first-class mail (other than airmail) involved a deficit of $840 million in fiscal 1952—instead of the Post Office's ascertainment of a $52-million profit.

Airlines want factors such as "value or service" and "what the traffic will bear" used as guideposts in determining postage rates, and the advisory council supports them on this stand. Although not exacting, these criteria, airlines feel, are more realistic than Post Office's ascertainments.

"For example," one airline spokesman remarks, "a letter carrier may deliver one airmail letter and 1,000 regular-mail letters on his route, but the cost of his service is divided fifty-fifty between the airmail service and the regular first-class mail service."

▶**Show Profit**—Post Office, however, wants to cling to the cost ascertainment system and objects in its report that "there is no statistical way by which these intangibles (such as 'value of service') can be measured."

Despite the possibility that airmail service was overcharged with general department overhead, the service showed a profit of $7.7 million in fiscal 1953. This was after deducting $49.8 million as airline subsidy, which Post Office no longer has to pay. The deficit before the deduction for subsidy was $42.1 million.

On helicopter service, the Post Office report commented:

"It is costly and provided only to the patrons in three metropolitan areas. We are not convinced that it is warranted. Accordingly, we are making a survey to ascertain comparative costs of surface and helicopter transportation. If the advantages do not outweigh the lower surface costs, we will drop the helicopter service. On the other hand, we will be able to establish standards leading to the proper choice of this type of service in the future."

Western Promotes Rail Travel

Travelers on Western Air Lines last week found a somewhat unusual folder in the promotion kits at their seats. It urged them to travel on Union Pacific Railroad.

The colorful folder was part of cooperative promotion plan to encourage travel in the West.

Western and Union Pacific, competitors for the tourist trade, have joined forces to promote the heavy traffic area of Las Vegas, Hoover Dam and Lake Mead.

▶**Advantages by Rail**—Attractive full-color booklets produced by Union Pacific to boost this national vacation area are being placed on each Western airliner, distributed through WAL ticket offices and mailed by the airline to its patrons throughout the West.

The booklet emphasizes the advantages of travel by rail, outlines rail schedules to the Las Vegas area and lists UP ticket offices in the nation. It contains a map of the UP system and color photos of Union Pacific streamliners.

▶**Sincere Gesture**—To the brochure, Western has attached this cover message:

"This folder on fabulous Las Vegas and the Hoover Dam-Lake Mead recreational area is so outstanding that we are happy to distribute it for our competitor in the hope of interesting you in a trip to Las Vegas. Those of you who don't go via Union Pacific will be very welcome aboard one of Western Air Lines' fast, frequent flights to Las Vegas."

Bert D. Lynn, advertising and public relations director for WAL, says the new plan is "a sincere gesture on the part of the two transportation companies because they are both interested in building the West."

Western operates 24 flights a day to and from Las Vegas.

McCarran Bill Asks Nonsked Regulation

Sen. Pat McCarran recommended economic regulation of nonscheduled airlines as hearings opened last week before the Senate Interstate and Foreign Commerce Committee on his 177-page bill rewriting civil aviation law (AVIATION WEEK, Jan. 25, p. 91; Mar. 22, p. 22).

"My bill provides that the so-called 'exemptions' now outstanding be terminated and that the (Civil Aeronautics) Board be directed to issue certificates of convenience and necessity covering irregular operations on the same basis that such certificates are issued to the scheduled air carriers," McCarran said. "We cannot have an industry half-regulated and half-unregulated."

▶**Testimony Delayed**—Testimony by government witnesses on the McCarran measure is being delayed a few weeks at the request of President Eisenhower. He asked that statements by Administration spokesmen be postponed until a review has been made of the coming report of Air Coordinating Committee on aviation policy, due May 1.

As a result, the committee canceled appearances scheduled for last week by Chan Gurney, CAB chairman; Robert Murray, Undersecretary of Commerce for Transportation; Fred Lee, Civil Aeronautics Administrator; John Allen, Assistant Postmaster General for Transportation; Thurston Morton, Assistant Secretary of State, and Harold Talbott, Secretary of the Air Force.

Six committee members attended the opening session: Sens. John Bricker, chairman; Andrew Schoeppel; John Butler; Edwin Johnson; John Pastor, and Mike Monroney.

▶**Avenue for Evasion**—Maintaining the nonskeds are not covered by the 1938 Civil Aeronautics Act that he co-authored, McCarran said:

"It would have been better for all concerned if the Board had brought this problem to the Congress years ago, rather than trying to write a new law of its own. The Board's efforts have involved it and the industry in many

difficulties since the end of World War II.

"By seeking to write a definition of an irregular carrier, they have made it difficult for a conscientious operator, who honestly seeks to run an irregular service, to know whether he is operating within the law or not. In the same way, they have opened up an avenue for evasion of the law, of which great advantage has been taken."

▶ **Development**—McCarran traced the development of aviation since enactment of the 1938 act:

- Airlines served 189 domestic points in 1938; 579 are today.
- Pan American Airways flew to 90 points in 1938; U. S. international airlines are serving 169 points at the present time.
- The airlift capacity of the U. S. scheduled commercial fleet has multiplied from approximately a million ton-miles in 1938 to 16 million.
- Cargo carriage by the domestic and international airlines has increased from 2.5 million ton-miles in 1938 to 253 million ton-miles.
- Domestic airmail volume has increased from 7.4 million ton-miles in 1938 to 72 million. International mail volume has increased from 300,000 ton-miles to 24 million, while the cost has dropped from $39 per ton-mile to an average $2.31.

▶ **Testimony Schedule**—The witnesses scheduled to appear before the committee:

Apr. 12—Leif Gilstad, vice president-transportation for Association of America; former Sen. Joseph O'Mahoney, North American Airlines counsel.

Apr. 13—Edmund Converse, president of Bonanza Air Lines.

Apr. 15—H. D. Johnston, executive director of Air Coach Transportation Assn.; Robert Quirk, National Air Freight Forwarding Corp.

Apr. 16—Francis A. Bolton, president of American Association of Airport Executives; Stuart Tipton, counsel for Air Transport Assn.

Apr. 20—W. A. Patterson, president of United Air Lines; Joseph McLaughlin, former president, and A. B. McMullen, executive secretary, National Association of State Aviation Officials; Ramsey Potts, president of Independent Military Air Transport Assn.; Giles Morrow, president of Freight Forwarders Institute; Robert Roland, executive secretary for Society of American Florists.

Apr. 21—L. R. Hackney, executive vice president of Transport Air Group; Robert Prescott, president of Flying Tiger Line; Mike Masaoka, representing Japanese Citizens League, Consolidated Flowers, Inc., Flower Consolidators of Southern California; Coates Lear, vice-president of Overseas National Airways; Ben Melnicoff, representing Argonaut Airways Corp., Continental Charters, Miami Airline, Peninsular Air Transport.

Apr. 22—C. R. Smith, president of American Airlines; Robert Ramspeck, vice president of Eastern Air Lines; Charles Parker, director of National Aviation Trades Assn.; William Kent, president of Flight Engineers' International Assn.

Apr. 23—J. B. Hartranft, president of Aircraft Owners and Pilots Assn.; Clarence Sayen, president of Air Line Pilots Assn.

CAB ORDERS

(Mar. 25-31)

SUSPENDED:

Caribbean American Lines' letter of registration.

Nationwide Consolidators, Inc., letter of registration.

Trans-Air Hawaii's letter of registration.

AUTHORIZED:

Piedmont Aviation to suspend service at Morehead City-Beaufort, N. C.

Trans-Texas Airways to omit service at Helena-West Helena and Stuttgart, Ark.

DENIED:

Flying Tiger Line permission to fly three roundtrip flights between San Francisco and Tokyo.

Mohawk Airlines permission to provide free transportation for various personnel of the Post Office Department.

Petition of Crystal City, Tex., and its chamber of commerce to authorize Trans-Texas Airways to serve Crystal City-Carizzo Springs.

Petitions of Frontier Airlines and St. Louis chamber of commerce to intervene in the proposed Continental Air Lines-Pioneer Air Lines merger.

Northern Consolidated Airlines application to engage in air transportation of mail, persons and cargo to Kaltag, Alaska.

GRANTED:

Transocean Air Lines authority to operate one flight between Paris and New York Mar. 30.

Consolidation of Northeast Airlines application for suspension of authorization to serve Provincetown, Mass., for five years together with earlier investigation to determine whether airline's certificate of public convenience and necessity should be changed to eliminate Provincetown.

Central Airlines; city of Abilene, Tex., and chamber of commerce; Austin, Tex., and chamber of commerce; Big Spring, Tex., and chamber of commerce; airport of El Paso, Tex.; Ft. Worth, Tex., and chamber of commerce; Albuquerque, N. M., and chamber of commerce; Carlsbad, N. M., and chamber of commerce; Hobbs, N. M., and chamber of commerce and the Lea County Airport Commission permission to intervene in the Continental-Pioneer Air Lines merger.

Riddle Airlines permission to engage in scheduled air transportation between Warner-Robins AFB, Macon, Ga.; Patrick AFB,

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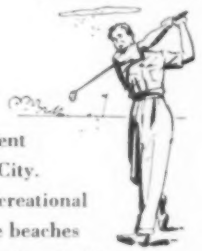

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Cocoa, Fla., and Maguire AFB, Newark, N. J.

Flying Tiger Line permission to use O'Hare International Airport at Chicago.

Slick Airways permission to use Philadelphia International Airport.

ORDERED:

Investigation of Pan American World Airways proposed 10-cents-per-pound cargo rate between New York and San Juan, P. R.

APPROVED:

Capital Airlines and American Airlines and various other intercompany arrangements.

Interchange of aircraft between Capital Airlines and National Airlines and various other air carriers.

Agreement between Pan American World Airways and various other air carriers.

REOPENED:

Proceeding into mail hauling by Inland Air Lines over its entire system and by Western Air Lines within the U. S. and between this country and Canada.

Chicago & Southern Air Lines (now Delta-C&S) mail rate case over its Latin American route.

DISMISSED:

Robert Dale Byers and Byers Airways' application for change in its certificate of public convenience as requested.

FIXED:

Final mail rate of New York Airways.

REVOKED:

American Airlines temporary exemption permitting the carrier to operate between New York and Mexico City.

SHORTLINES

► **Air France** claims a nonstop Mexico City-New York record, making the run Mar. 26 in 6 hr., 29 min.—4 min. under the previous mark.

► **Canada** and Peru have signed a bilateral air transport agreement.

► **Swissair** will begin weekly all-cargo service from New York to Frankfurt, Basle and Zurich May 1.

AVIATION CALENDAR

Apr. 12—Society of Automotive Engineers, second annual Aeronautics Production Forum, Hotel Statler, New York.

Apr. 14—National Advisory Committee for Aeronautics, symposium on helicopter research for American Helicopter Society, Langley Field, Va.

Apr. 14-16—Society for Experimental Stress Analysis, spring meeting, Netherlands Plaza Hotel, Cincinnati.

Apr. 15—Material Handling Institute, third "traveling clinic," Congress Hotel, Chicago.

Apr. 19-20—Symposium on automatic production of electronic equipment, sponsored jointly by Stanford Research Institute and USAF, Fairmont Hotel, San Francisco.

Apr. 21-23—Air Line Pilots Assn., second annual Air Safety Forum, Chicago.

Apr. 22-23—Joint meeting of Radio Technical Commission for Aeronautics, Franklin Institute Laboratories, Institute of the Aeronautical Sciences (Philadelphia Section) and Institute of Radio Engineers (Philadelphia Section), Franklin Institute, Philadelphia.

Apr. 26-30—American Society of Tool Engineers, 10th biennial industrial exposition, Convention Hall, Philadelphia.

Apr. 29—Institute of Navigation, eastern regional meeting, Friendship International Airport, Friendship, Md.

May 5-7—Third International Aviation Trade Show, managed by Aircraft Trade Shows, Inc., 71st Regiment Armory, New York.

May 6-8—Institute of the Aeronautical Sciences, first annual West Coast Industry-Faculty Conference and fourth annual West Coast Student Conference, Los Angeles.

May 10-12—Institute of Radio Engineers, National Conference on Airborne Electronics, Biltmore Hotel, Dayton, Ohio.

May 11—Daniel Guggenheim Medal Board of Award, annual meeting for preliminary selection of 1954 candidates, Engineering Society Building, New York.

May 16-19—American Association of Airport Executives, convention, Louisville, Ky.

May 20—Women's National Aeronautic Assn., 1954 Skylady Derby for stock model aircraft of 300 hp. or less, Raton, N. M. to Kansas City, Mo.

May 21-22—Operations Research Society of America, second annual meeting, Edgewater Beach Hotel, Chicago.

May 31-June 11—Canadian International Trade Fair, to be held in conjunction with the National Air Show and Canada's Aviation Day, Toronto.

June 2-4—Triennial industry inspection of NACA's Lewis Flight Propulsion Laboratory, Cleveland, Ohio.

June 5-12—Philadelphia Junior Chamber of Commerce, second annual Transcontinental Air Cruise for stock model aircraft of 300 hp. and less, Philadelphia to Palm Springs, Calif.

June 21-24—Institute of the Aeronautical Sciences, annual summer meeting, IAS Building, Los Angeles.

June 24-26—American Helicopter Society, 10th annual forum, Washington, D. C. Technical sessions: Mayflower Hotel, June 24-25; copter air show at Polo Field, June 26.

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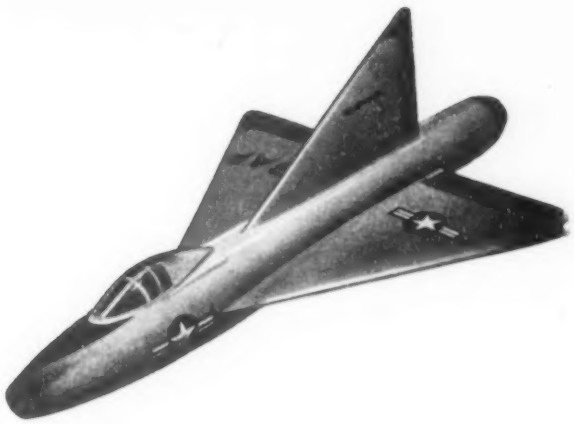

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What Happens When You Drink?

Ross McFarland book summarizes latest research on results of mixing liquor and flying; they're not good.

The ever-popular aviation discussion piece—why flying and alcohol don't mix—gets new source material in a book that is becoming a classic in aviation.

Use of alcohol in moderation may have no harmful effects to the body over a period of time, but airmen should understand how it lowers their skill in flying and leads to errors of judgment and liability to accidents, Dr. Ross A. McFarland writes in "Human Factors in Air Transportation," published by McGraw-Hill, New York.

Here are latest facts you probably didn't know about alcoholic imbibing and its results on the human body, as reported by Dr. McFarland, and extracted from his book by AVIATION WEEK, with permission of the publisher:

▶**The Process**—Alcohol is rapidly absorbed without requiring digestion. . . . Alcohol appears in the blood within a few minutes after it is ingested, especially if taken on an empty stomach, and shortly after in the organs and tissues.

Several factors that influence the concentration of alcohol in the blood and the rate of absorption are:

(1) The total amount of alcohol in a drink has a direct relationship to the concentration in the blood.

(2) The dilution of a drink directly influences the rate of absorption.

(3) The presence of food, especially such fatty substances as cream, milk, butter, or vegetable oils, retards the rate of absorption.

(4) The variety of beverages has a marked influence; the alcohol of brewed beverages, such as beer, is absorbed more slowly than distilled liquor because the carbohydrates and other material in the beer act like food in slowing the process.

(5) By drinking slowly and allowing time between drinks, an opportunity is given for the body to dispose of some of the alcohol before more is added, and the concentration of alcohol in the blood does not rise so high as with rapid drinking.

▶**Physiological Effects**—Although many believe that alcohol has a stimulating effect, studies of the electrical potentials of nervous impulses have shown that the **apparent** stimulating action is caused by a paralysis of the inhibitory centers and not by action on the central nervous system directly. . . . There is a temporary increase in pulse rate, blood pressure, and depth of breathing. . . . The small blood vessels in the skin become dilated, resulting in an increased blood flow to the skin.

This produces a feeling of warmth but leads to the loss of heat by radiation from the body and reduction in body temperature. Therefore, alcohol should not be taken during exposure to cold environments . . . If small quantities of alcohol are taken before meals, an increased appetite may result because of irritation of the mucous membranes in the mouth and digestive tract. . . . The amount of hydrochloric acid in the gastric secretions is markedly elevated, accounting for the deleterious effects of alcohol on ulcers.

▶**Psychological Effects**—Contrary to popular belief, its action on the nervous tissue is that of a depressant rather than a stimulant. After taking alcohol, a great majority of subjects manifest poorer performance in muscular skill, sensory acuity, memory and other measurable psychological functions.

In general, alcohol influences sensory, motor and mental functions adversely, the relative extent varying directly with the amount ingested and the reaction being investigated. . . . Movements of the eye while reading or fixating on an object show significant variations in efficiency, averaging 21% of the normal values after 1½ pt. of beer or one to two ordinary cocktails.

Alcohol has a pronounced effect on mental performance, such as memory, judgment, and reasoning. Although the magnitude of the effect varies from person to person, its direction is never reversed. In memorizing poetry or interpreting a code, alcohol invariably tends to diminish effectiveness. The primary effect seems to be that attention and concentration are rendered less flexible for receiving new stimuli.

▶**At Disadvantage**—Obviously, a pilot who is under the influence of alcohol would be at a great disadvantage in remembering to check his instruments, in making complicated decisions, or in carrying out many other duties while flying modern highspeed aircraft, Dr. McFarland points out. In aviation, there is not only the influence of alcohol alone to be considered, he says, but also the way in which altitude may accentuate these reactions.

A code of honor exists among airline pilots that forbids drinking 18 hours before or while on duty. Many pilots are total abstainers, and less than 2 or 3% constitute problem cases. Occasional excesses may occur, but disciplinary action coming from the pilots themselves is most effective. The Air Line Pilots Assn. does not defend an airman if it can be proved that he was drinking just before or while on duty.

A survey of the regulations of 10 airlines in the U. S. regarding the use of alcoholic beverages by flight crews was made by the author. There was unanimity in regard to the rule that all airmen must refrain from the use of alcohol while on duty and that violation of the regulation constitutes a basis for immediate suspension or dismissal.

▶**Time Limits**—All companies stated that they do not allow flying personnel to frequent public bars or cocktail lounges while in uniform even though they are not drinking. In addition, they all stated that no alcoholic liquors should be consumed within a definite time before going on schedule, takeoff, or flight duty. There was, however, some difference in regard to this limit; two companies placed the time limit at 12 hours, while the remainder required an interval of 24 hours to have elapsed since the last drink before going on duty. . . . In the opinion of the author, if only moderate amounts are taken before meals, 18 hours is reasonable.

⅓ Oz. an Hour

"There is considerable individual variability in the rapidity with which alcohol is absorbed from the gastrointestinal tract," Dr. McFarland writes. "In some instances, habitues have been found to absorb alcohol more slowly than neophytes. A large proportion of alcohol, usually more than 90%, is oxidized in the body, the initial stages occurring in the liver.

"Only a small fraction, less than 5%, is eliminated unchanged. A man of average weight can burn about ⅓ fluid ounce of pure alcohol an hour. Neither exercise nor any other procedure commonly employed to attempt to ameliorate intoxication is effective in causing the alcohol to burn more rapidly. Drinking black coffee, for example, serves to stimulate the brain, which has been depressed by the alcohol, and thus tends to counteract its effects. The inhalation of excess quantities of oxygen and carbon dioxide tends to increase the rate of elimination or oxidation, as is the case when insulin is injected."

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Dear Sir: Please send me an application form and illustrated brochure describing life and work at Lockheed in California.

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***New in operation:** Lockheed's new De-Icing Tunnel, the first to be owned and operated by private industry.

LETTERS

Insurance & Nonskeds

Your Mar. 15 article on insurance, p. 323, was timely reporting. . . . When the New York State Court of Appeals ruled that an airport vending machine insurance company must pay off on a passenger killed in a non-scheduled airline crash, it was doing its duty to the public. While the vending machine policies specifically state that they do not cover non-scheduled airline flights, it would be interesting to know how many people have put their money in the machine, written out their insurance, and gone blissfully on their non-scheduled flight, thinking they were covered. As a matter of fact, all that had transpired was that some small fine print, and a very reassuring looking machine, had hooked them out of a quarter.

In view of this decision, perhaps the insurance company will set up two machines, scheduled and non-scheduled, with the rates adjusted to what experience has shown the risks to be. Under this condition, I don't think the average layman would long continue to have trouble with the definition of the terms scheduled and non-scheduled.

JOHN R. CHEWNING
1635 Lydia Ave.
Elmont, N. Y.

Auto Feathering

This time, I believe, Capt. Robson has gone too far in his philosophizing about things aeronautical ("Case Against Auto Feathering," AVIATION WEEK Feb. 22, p. 112) . . .

His stand on the value of the auto-feather installation of the Convair is not only archaic but downright dangerous! . . .

I am a captain in the USAF, an instructor in the Convair and have accumulated 7,000 hours in various and sundry type machines. . . .

Prior to my recall into the service last July, I was an executive pilot—and had been since 1945. . . .

Several weeks ago I delivered an aircraft to Miami and rode the commercial route back to Houston—in a Convair.

Naturally, one pilot will talk to another so I started a conversation with the pilot of the airliner regarding the Convair, his likes, dislikes, etc., during which he showed a glaring ignorance regarding the auto-feather feature on his machine. He not only didn't think much of it but was under the impression that his props had to be in low lights before it would work.

Later on, his co-pilot gave me the word on the gimmick but he claimed that the props had to be in hi-lights. . . . Two men on the same plane with two different ideas! . . .

Now, I'll wager that the good Capt. Robson could not tell me, in time, which engine failed, should he have one give out on takeoff. At least, not soon enough to be able to do anything about it! With all of the lights, of various types, in the cockpit of the Convair he wants to add to them by prop warning lights of some sort. Phooey!

The clincher to the good captain's argument is the number of falsies he claims has happened. Well, that may be so, but I'll counter that with a few figures of our own. . . . Here at Ellington AFB we have never had an inadvertent feather and we are flying in excess of 150 missions each day, plus four ships in transition. The transition boys are shooting in the neighborhood of 60 landings each per day, by the way!

And not only that, but I have never read an Air Force report of any happening to the T-29 as we call them. And we have over 300 in service!

Really, Captain, let's keep it in the vein we know or do it for laughs like Hi Sheridan!

No, you needn't cancel my subscription. I not only enjoy your magazine but intend to have it delivered as long as it is printed.

MELVILLE W. MISSALL, Capt., USAF
714 Ruell St.
Houston, Tex.

P. S. How does he feel about the torque meter? The DC-3s didn't have them either so they shouldn't sit too high in the good captain's esteem!

The Turbo Compound

I was extremely interested in your article Feb. 8, reporting on American Airlines DC-7 "Teething Trouble."

I personally feel that the Wright R3350 Turbo Compound engine should not necessarily be considered a "new-type powerplant," as inferred in your article. Perhaps they are to American Airlines, but I believe it is general knowledge in the industry that the engines have been flying in Lockheed P2Vs since 1949 and Lockheed Super Constellations since early 1952. This certainly takes them out of the "new-type powerplant" category and also means a lot of bugs were taken out prior to American Airlines use.

Your article also spoke of Wright devising a fix for increasing the strength at the intersection of the exhaust nozzle with the nozzle box casting by installing a reinforcing doubler and gusset at that point. We at Lockheed have been touting Wright for almost two years for this same fix for another reason in addition to the one noted above. We are glad to see a public admission that some action finally has been taken.

The article was very informative and interesting to the writer who has been closely associated with Turbo Compound powerplants since their early introduction on the Lockheed P2V, and subsequently the Lockheed Super Constellation, which of course we believe to be the finest four-engine transport of its type available in the world. I sincerely hope your magazine publishes similar informative articles in the near future of other airlines' experiences with Turbo Compound engines in our Lockheed Super Constellations.

AUSTIN WICKWIRE,
Lockheed Engineering Rep.
Chula Vista, Calif.

Engineers & Jobs

Your News Sidelights column commented Jan. 18 on "Why aircraft engineers change jobs."

Please refer your recruiter friend to a recent and reputable text titled "Executive Action," by Learned, Ulrich and Booz, published by the Harvard Business School, 1951.

If he will turn to page 75 he will find a more logical explanation of why junior professional men in general who are seeking success change jobs.

Let me quote:

"At the more junior levels, the sudden discovery that 'success' may entail long years of apprenticeship in an established company leads often to an acute sense of frustration. This attitude is most likely to develop when the younger man has put in a good many years of preparation at the college or graduate level in the hope that it will pay off in accelerated progress when he goes to work.

"Yet the odds against starting a new venture without capital and making a go of it are so great as to induce many energetic and capable younger men to stay within the established limits of older companies. The inevitable result is that the more ambitious of the younger men may shift from company to company with a frequency which leads their elders to regard them as restless or irresponsible. Such shifting may, however, be their only effective means of improving the odds on success."

Although aircraft engineers were not being specifically considered in the above quotation, I believe the situation applies.

W. B. HOWARD
550 11th Ave., W.
Kirkland, Wash.

Lots of Zeroes?

I want to take exception to Stuart Symington's remarks regarding "thousands of Zero fighters prior to World War II" (Feb. 22 issue, page 13): Mr. Symington has been misinformed.

Japan had produced 444 Zeke fighters up to Dec. 1, 1941. Mitsubishi had produced all but 1 of these. The Zeke (A6M-1) II had been accepted in 1939, but failed in carrier tests.

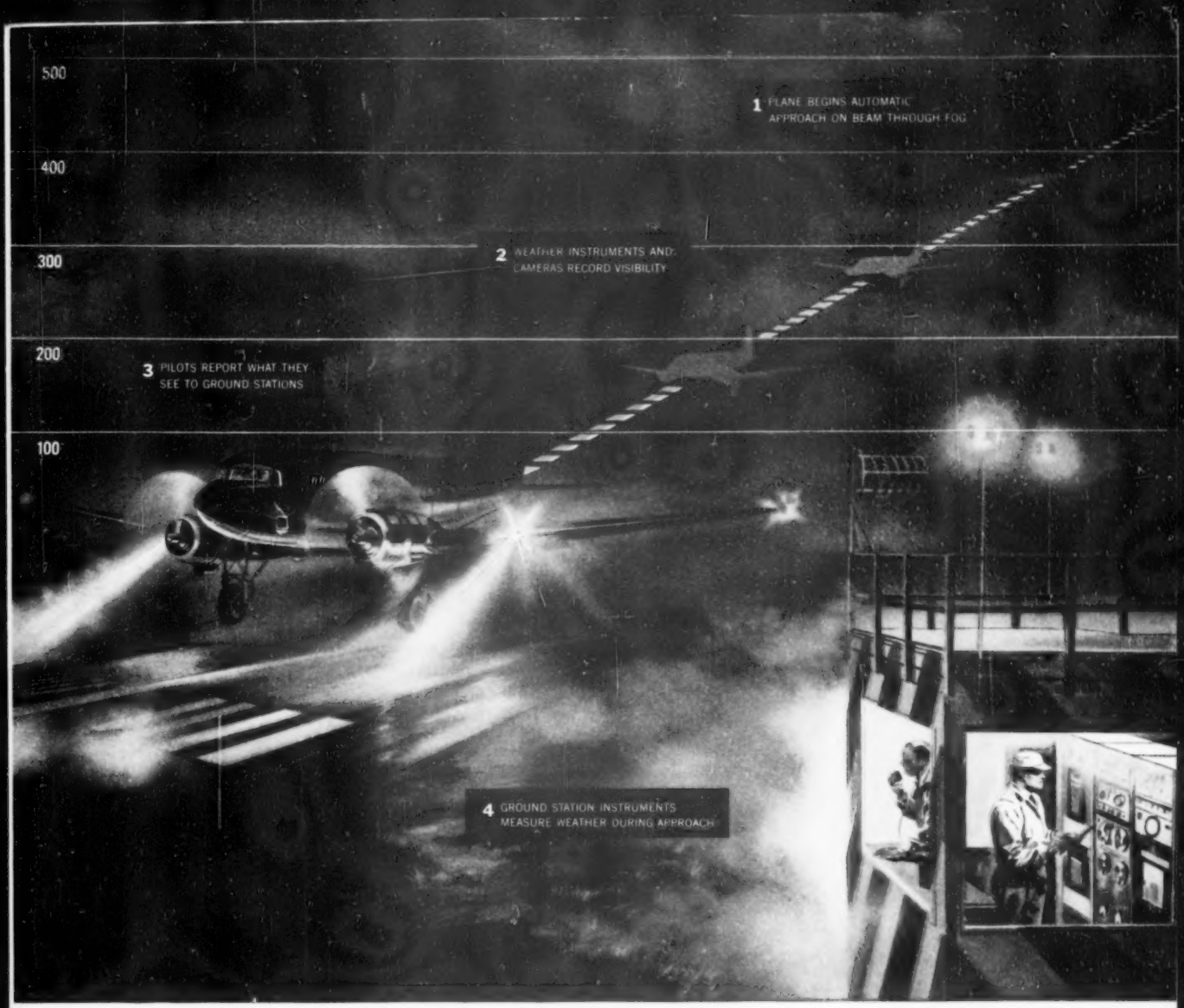
Only 3 prototypes were produced that year.

The machine was finally accepted in the summer of 1940 as a carrier fighter and 98 aircraft were produced that year. So, actually, the Zeke had been in squadron service only a year and could not possibly have been produced by the "thousands."

A sum total of 10,934 Zeke type "O" aircraft were produced from its inception: Mitsu, 3,879; Nakajima, 6,215. Nakajima also built 323 "Rufes," which was a float-plane version.

Hitachi and the 21st Naval Air Depot built 517 Zeke Jrs., which was a two-seated fighter trainer version.

M. A. SALO,
5824 Songfest Drive
Rivera, Calif.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1 PLANE BEGINS AUTOMATIC APPROACH ON BEAM THROUGH FOG
2 WEATHER INSTRUMENTS AND CAMERAS RECORD VISIBILITY
3 PILOTS REPORT WHAT THEY SEE TO GROUND STATIONS
4 GROUND STATION INSTRUMENTS MEASURE WEATHER DURING APPROACH

Flying Lab makes 500 Landing Approaches in "Pea Soup"

THE STORY BEHIND THE STORY:

■ IF YOU'VE BEEN a passenger in a plane "stacked" above a fogged-in airport—or if you've been the pilot at the controls—you were certainly interested in headlines like the above appearing in newspapers a few months ago.

■ Behind those headlines is the dramatic story of men flying when "even the birds are walking," making landing approaches over and over again, to make your future landings safer in bad weather.

■ Working with the Air Navigation Development Board and the U. S. Weather Bureau, Sperry flight research personnel have completed 500 bad weather landing approaches in a flying laboratory equipped with specialized instruments. In flight, both manual and automatic recordings are made of conditions encountered during the final 500 feet of descent.

■ On the ground, trained observers report what they see, and monitor automatic instruments which measure ceiling and visibility conditions existing in the runway approach zone. Synchronized and analyzed, these records reveal the accuracy of the instruments and establish a wealth of information so pilots will know what weather to expect along the line of descent.

■ Because of its many years of experience in low ceiling approaches, Sperry was selected by the government to make the weather measurement study. This project is typical of the exacting flight research which is continuous at Sperry—flight research not only to perfect Sperry instruments and controls, but to advance the operational efficiency of both commercial and military aircraft.

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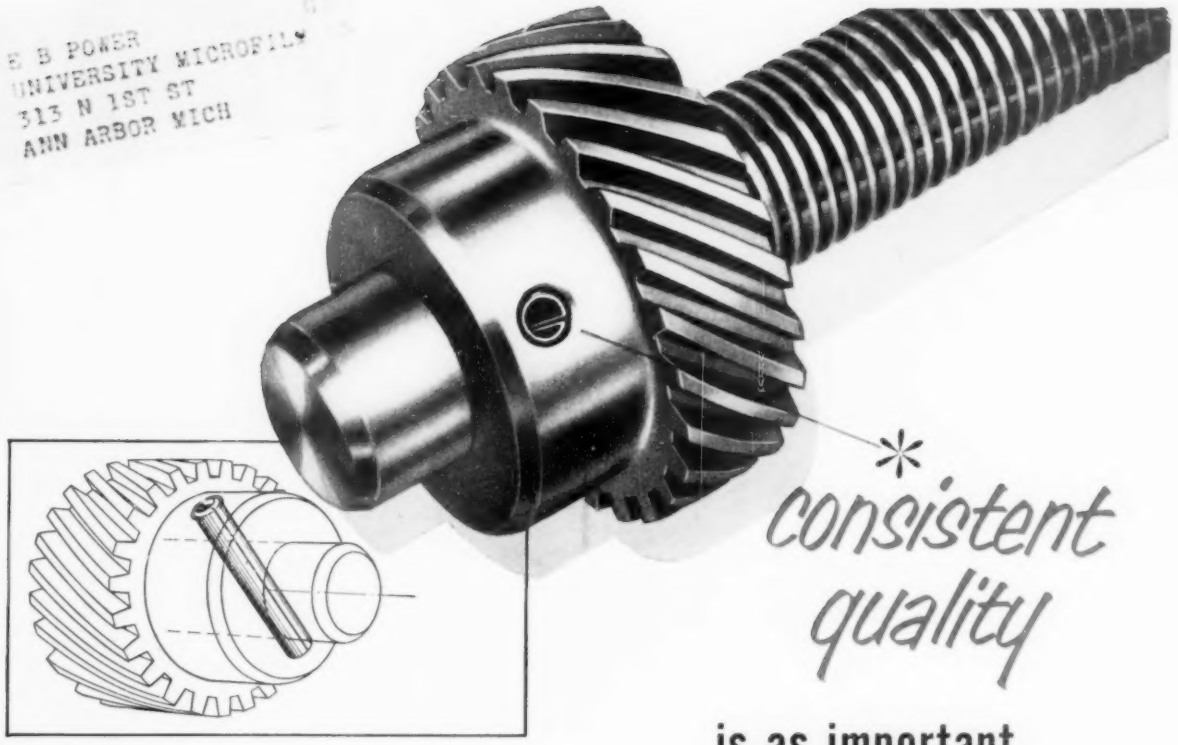
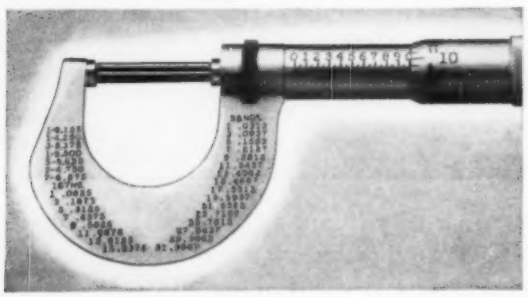


consistent quality

is as important in the pin as in the gear

To function effectively, a spring pin must drive easily into holes drilled to normal production tolerances, compressing as driven. To drive easily, hold firmly and fit flush, the pin —*every* pin—must meet the strict requirements of specifications such as those prepared by the SAE and the Military Services.



Since failure of a pin can be as costly as a failure of any other precision part, it is important to check the pins *you* buy for uniformity . . . uniformity of diameter and length, shear strength, hardness, insertion and removal forces, and recovery of diameter.

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